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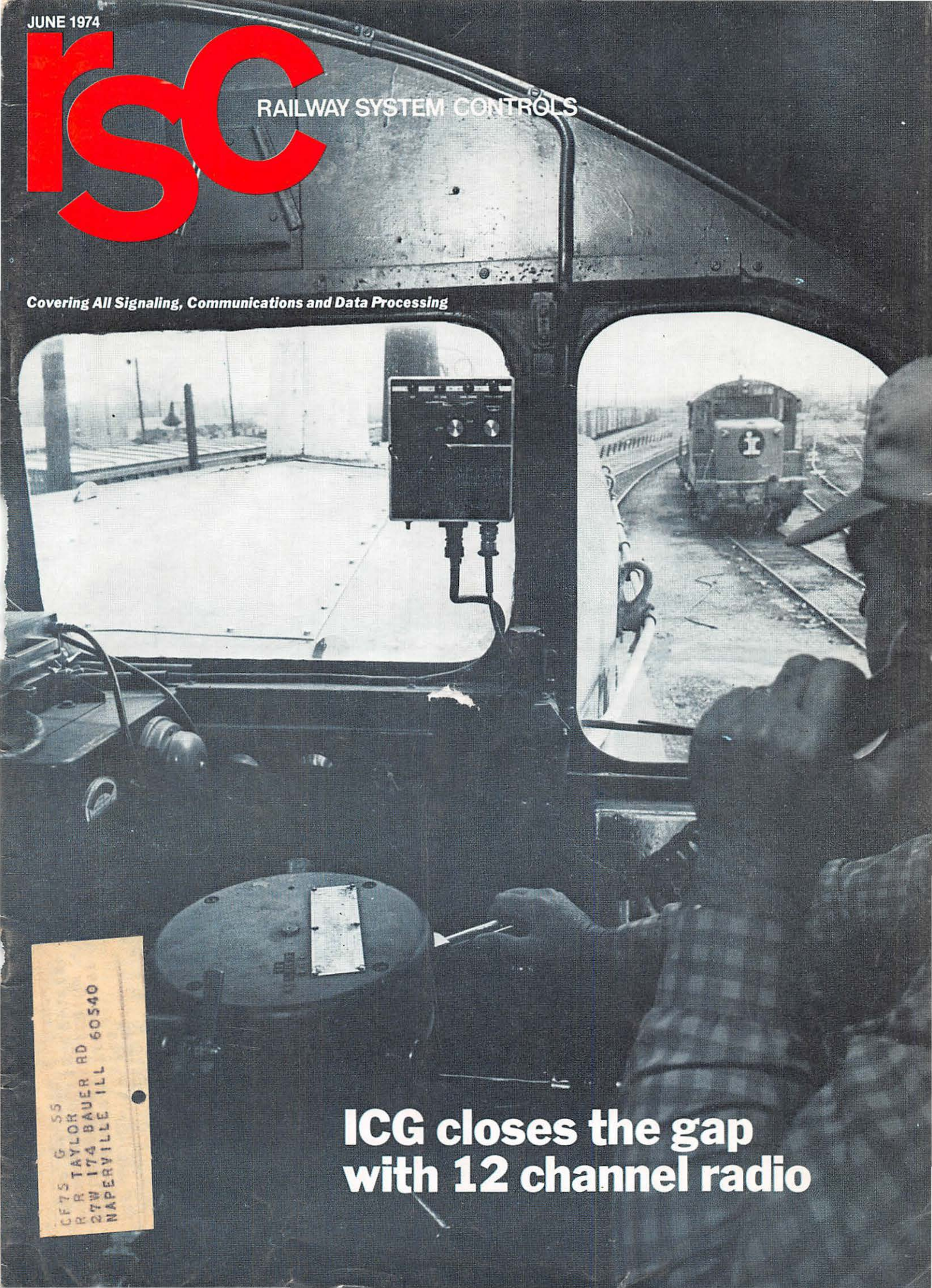

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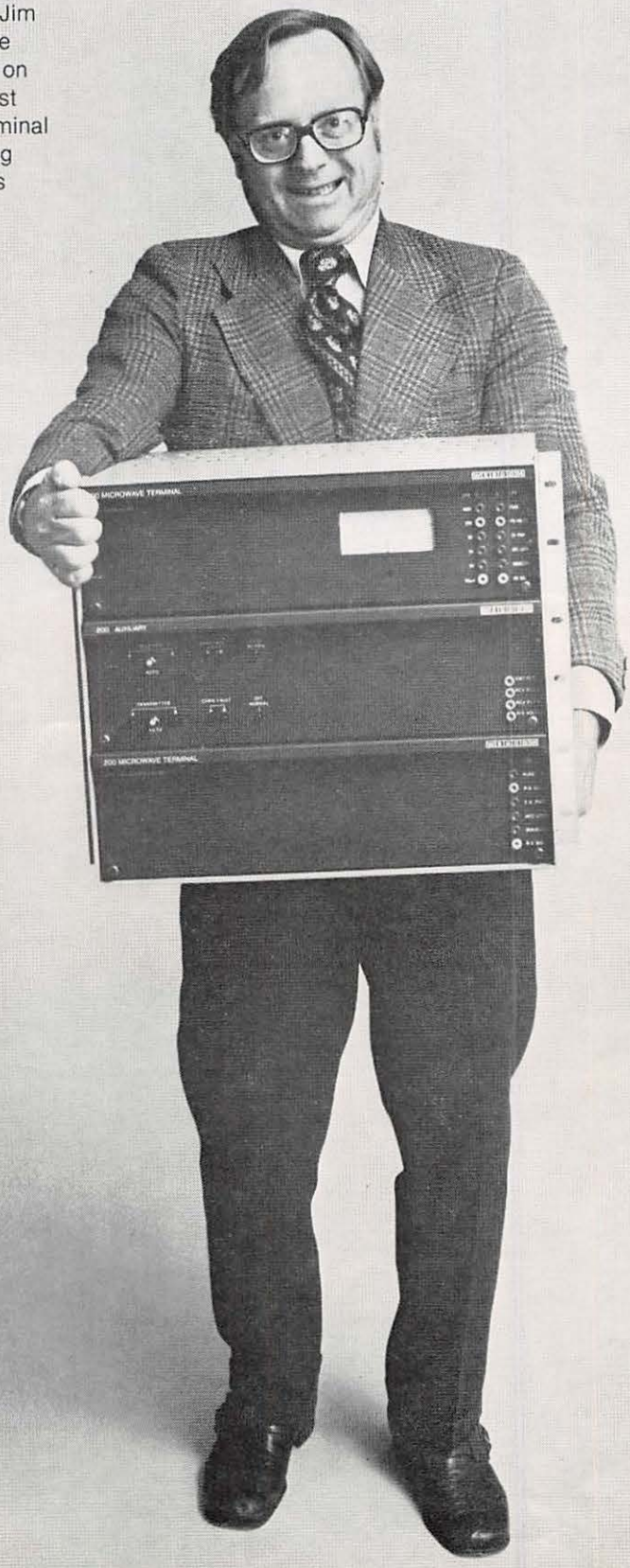

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(Formerly Railway Signaling & Communications)

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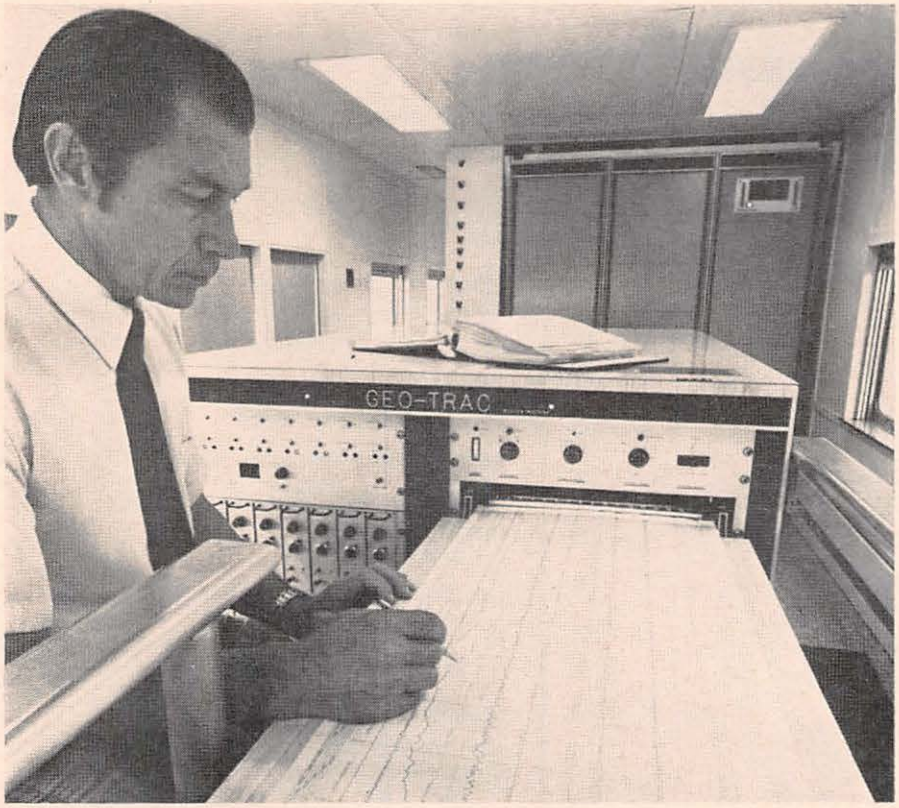
RSC News



Santa Fe minicomputer processes data for track maintenance

As part of Santa Fe's specially equipped, diesel-driven Track Geometry Car, a Nova 1220 minicomputer hurtles along at speeds up to 80 miles per hour, gathering and processing data that allow Santa Fe's track engineers to plan effective track maintenance.

In operation, the 200,000-pound Track Geometry Car uses optical encoders and contact feelers that make all necessary measurements—warp, surface of both rails, gauge, superelevation, alignment of both rails, lateral and vertical acceleration—and converts them to signals used to drive recording equipment inside the car.

Signals transmitted from the measuring instruments are received by two parallel sets. One produces traces on an analog strip chart; the other feeds data to the computer. Additional data such as mileposts, distances and key landmarks are entered through separate analog channels to geographically "position" the track measurements for future maintenance efforts.

On board the moving track geometry car, the minicomputer monitors incoming data channels, stores its information on fixed-head-disc and magnetic tape, and issues immediate reports of priority locations with a 500 character-per-second line printer. The line printer also produces one-mile summaries of each type of defect and an overall rating index for each type of defect and an overall rating for each mile of track covered.

The data acquired by the minicomputer and stored on magnetic tape are eventually processed off-car and compiled into a master track file to be used for planning future, long-term maintenance programs and rebuilding expenditures. The Santa Fe envisions this information being used for more sophisticated analysis, such as determining track wear and performance of cars traveling at different speeds, finding operating levels for maximum passenger comfort, and producing guidelines for the design and maintenance of future railroad cars.

WABCO to supply automatic classification facility for SCL

Union Switch & Signal Division of WABCO has received a multi-million dollar order from the Seaboard Coast Line for a new automatic freight classification facility to be installed at Rice Yard, Waycross, Ga.

The order includes engineering design, dual digital computers for process control to include a data link with SCL's Operating Information System in Jacksonville, and CRT displays and input devices for information reports. The model 67 WABCO car retarders will be controlled by a Velac VR-3 digital computer control system. Additional equipment includes DA-10 switch machines, track circuits, presence monitors for long car switch locking protection, weight proportional skate retarders and WD-30 wheel detectors for car tracking. A WABCO LSR-100 hump locomotive speed control system is also being installed on four hump locomotives to provide automatic speed control from the humpmaster's control console. Control consoles are also being supplied for the receiving yardmaster and the pullback and forwarding yardmaster.

Communications '74 to be held in Chicago

The National Electronics Conference, Inc. will be holding it's 30th anniversary conference/exhibition on Oct. 16, 17 and 18 at the Hyatt Regency convention center in Chicago.

The internationally recognized Annual NEC engineering program attracts engineers from throughout the nation. More than 7,000 engineers are expected to be attending the New Technology Program which has been developed by NEC. These six-hour, two-day, seminars present the latest significant research and application results from the subject areas presented. NEC/74 exhibitors will display and discuss new products and developments in meeting rooms located in the exhibit area.

IEEE Symposium to be held in San Francisco

The IEEE International Symposium on Electromagnetic Compatibility will be held in San Francisco on July 16-18, 1974. A total of 59 papers by authors from eight countries will be presented Topics to be presented and discussed are to include areas such as the effect of thunder-storms on radio wave propagation, new policies and procedures established by the Federal Government in the area of spectrum management, reliability of microwave digital communication links in the presence of atmospheric noise, control of electromagnetic pollution, effects of interference on semiconductor devices and many others. The IEEE International Symposium on EMC will be held at the San Francisco Hilton Hotel.

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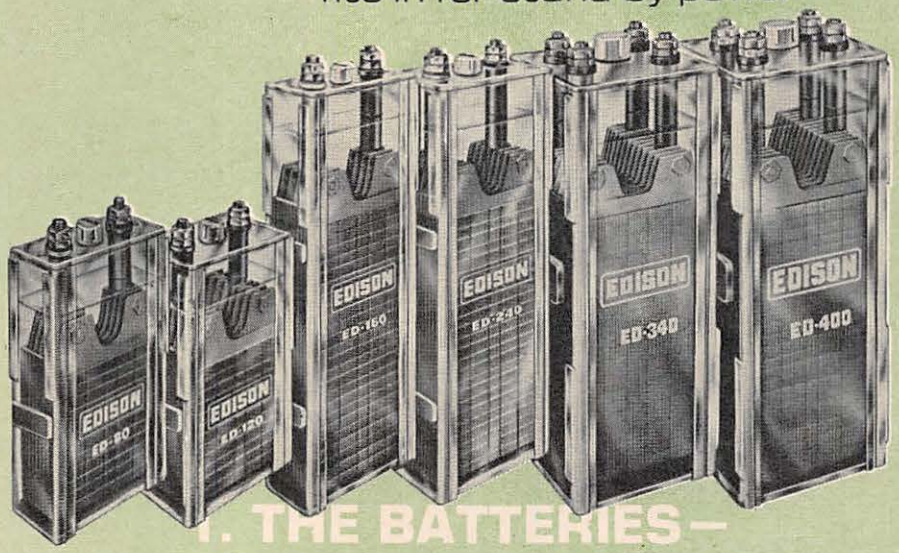

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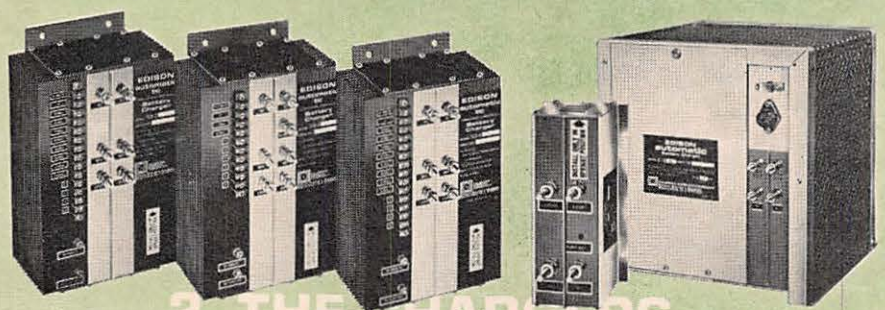

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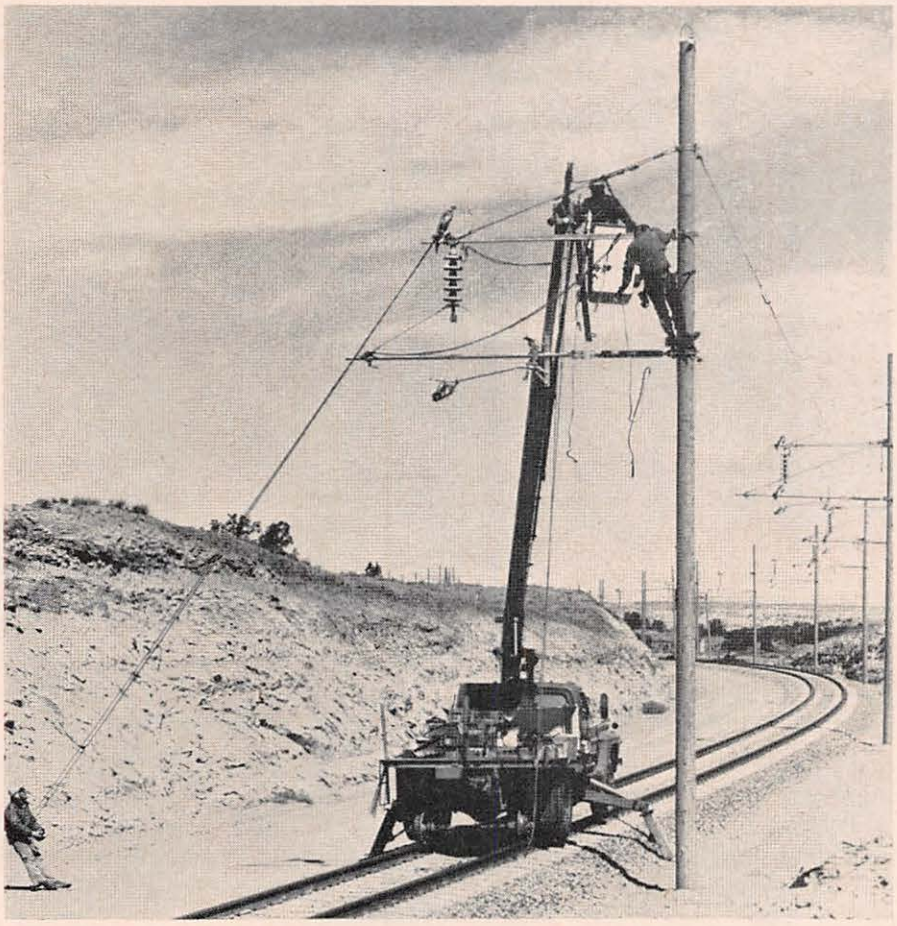

Black Mesa & Lake Powell uses wood poles for fast work

The nation's first 50,000-volt electric railroad—powered by three 6,000-horsepower locomotives—the Black Mesa & Lake Powell, is distributing power with a 78-mile-long column of poles, a major portion of which were treated for enduring protection against decay and termite attack.

Choice of wood poles over concrete was made on the basis of economy and speed of installation. The installation crews were able to embed the Douglas fir poles at a rate of one an hour without the use of any special foundations.

In the Cellon Process, developed by Koppers Co. of Pittsburgh, the preservative, pentachlorophenol, carried in liquefied butane solution, is pressure injected deep within the wood cross section. After impregnation of the wood the butane carrier is evaporated. When removed from the treating cylinder the wood is said to have a dry paintable surface which can be worked with and painted or finished as readily as untreated wood.

"Who's on Top?" to be featured at INFO 74

"Who's on Top—You or Your Information System?" is the keynote which will open INFO 74, the first in an annual series of conferences and expositions which focus on the information system as a significant new concept that management must learn to understand.

Sponsored by the American Management Associations and produced by Clapp & Poliak, INFO 74 will emphasize the use of information systems rather than the technological aspects, although theory, practice and implementation also will be covered.

Both conference and exposition take place at the New York Coliseum, Sept. 9-12. Ten sessions have been set aside for transportation electronic data processing managers and technologists and five others, also for EDP managers and technologists, may be shared by management executives who wish to learn information technology.

A "'Visitors Guide to INFO 74," which provides the conference program, a list of exhibiting companies and

Why 19

Servo is the world's leading producer of electronic hot box detector systems.

We're not experts in every phase of railroad safety—but as the industry's pioneer designer and producer of electronic hot box detection systems, we can claim a high level of successful experience in working on the problems of bearing failures, axle burn-offs and derailments associated with undetected hot boxes.

Since 1957, more than 1,800 SERVOSAFE Hot Box Detective Systems have been put into service, and have compiled an unequaled record of safety improvement, more efficient preventive maintenance procedures and cost reduction.

Hot box detectors available from Servo offer the widest flexibility in choice of system configuration, features and functional options, including: rail-mounted or ballast-mounted scanner; a complete selection of ancillary and test equipment; solid-state electronic signal processing. Several modes of data read-out are also available—automatic digital read-out at trackside or remote location; pen-paper recorder chart for visual interpretation; FM carrier data transmission over unlimited distances.

With our broad range of products and world-traveling network of field engineers, we can readily "customize" the design, manufacture, installation and operation of a SERVOSAFE System to best meet the particular requirements of your railroad.

You are invited to contact us for complete descriptive literature, or to arrange a field engineering site survey and application review—without obligation, of course.

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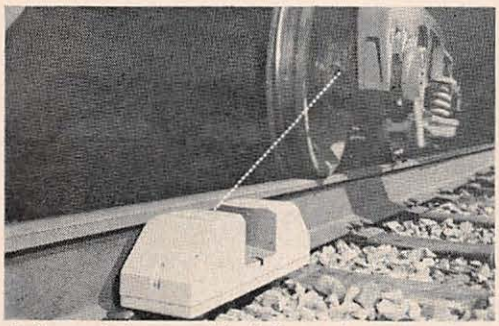
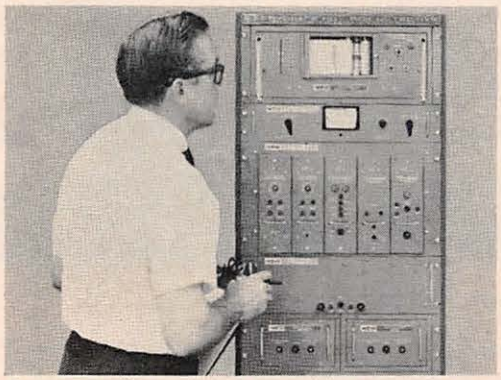
are 71 railroads in countries using SERVOSAFE®?

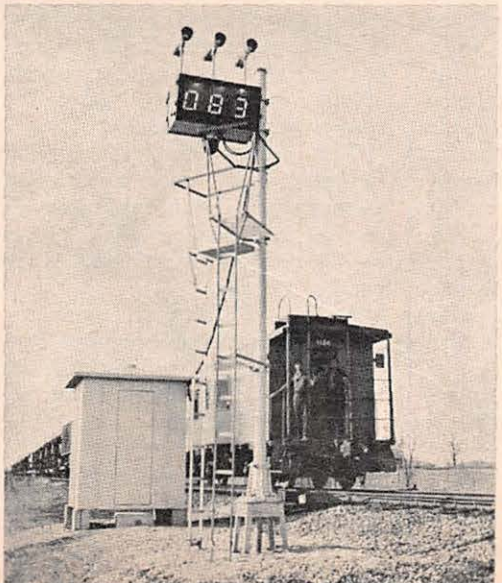


Rail-mounted scanner "looks" at and measures the heat radiated by passing journal boxes.



Solid state electronic data processing equipment, with permanent record chart recorder.

Trackside display board gives digital read-out of hot box location.



Because today's faster, heavier trains—running for longer distances between inspection stops—have placed even greater emphasis on one of railroading's oldest problems: the overheated journal box. Wheel bearings are operating under more stress, and are more vulnerable.

Technological developments such as better lubricants, improved bearing designs and lubricator pads have all been employed by railroad managements to help solve the problem. Another significant step taken has been the increasing use of roller bearings. While these advances have helped, they have also made traditional methods of journal box inspection extremely difficult. The smoking oil fire indicating a friction bearing hot box is now a rare occurrence. A roller bearing that is about to fail seldom gives a warning sign that can be seen by eye. An automatic method for detecting hot boxes has become a necessity. The SERVOSAFE® Hot Box Detective™ System meets today's needs by providing for the automatic location of bearings that are running hot, so that action can be taken promptly after detection.

Railroads use SERVOSAFE simply because it has proved itself, in actual field service, to be the most practical, most effective method of combatting costly damage and derailments caused by defective overheated bearings.

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RSC News

(Continued from page 6)

what they will demonstrate, hotels and similar information, is available from Clapp & Poliak, Inc., 245 Park Ave., New York, N.Y. 10017.

AAR's TRAIN II equipment being installed

An IBM 370/158 computer, first unit in the AAR's TRAIN II network, has been installed at headquarters in Washington, D.C. This third-generation computer equipment has a capacity that makes it two and a half to four times faster than the model presently in use on the railroads' TeleRail Automated Information Network. The present system handles up to 300,000 car reports on a peak day and averages about 9 million per month. The new system, to be operational in 1975, will be capable of handling up to 1.4 million reports a day or about 42 million a month. R. B. Curry, vice president of AAR's Management Systems Department says that TRAIN II will provide a much broader information base than the present system, and data will be updated frequently each day instead of once a day as at the present time.

A second communications controller is among the additional new equipment scheduled for installation during the next five months. Other new equipment to be installed includes:

- Spindle disc storage units which will give a capacity for "on-line storage" of 5 billion characters of information, compared to a present capacity of one billion characters.
- An additional eight tape drives capable of recording 6,250 characters per inch, compared with the 1,600 characters per inch for eight units already in use.
- An additional 2,000-lines-per-minute printer for hard copy, bringing to three the number of such units serving the center's computers.
- Ten CRT's which will give instant monitor displays of on line information in the AAR's Car Service Division.

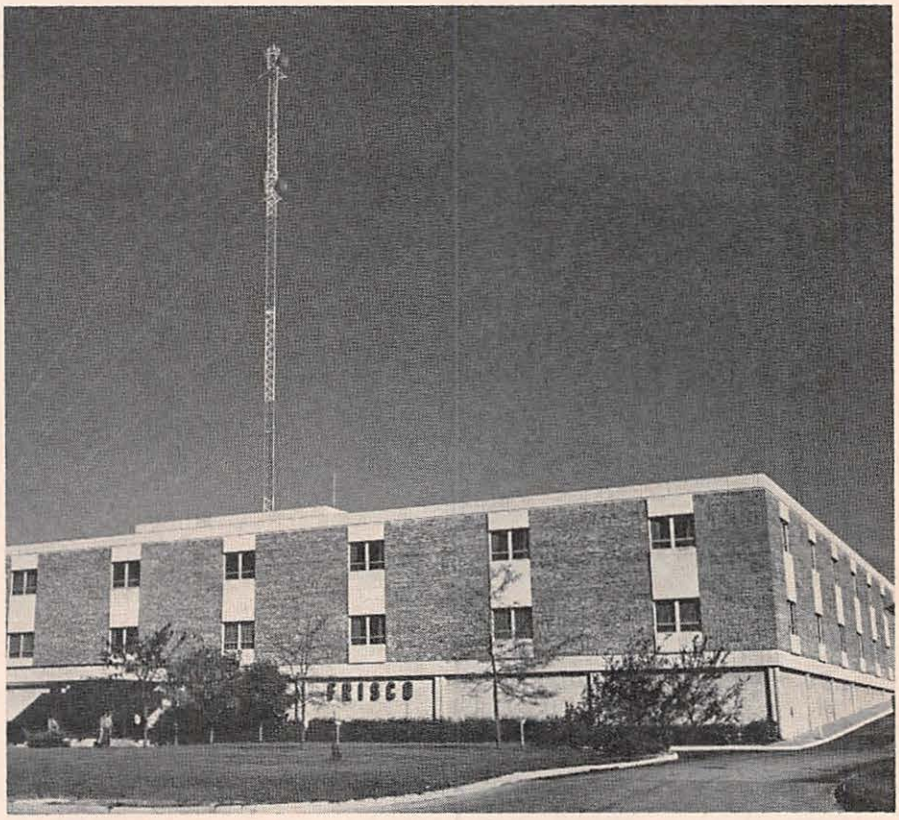
Mr. Curry said testing of the new equipment will start as soon as it is installed so there will be no delay in introducing the expanded TRAIN II information program next year. Curry also stressed that while the present TRAIN I reports only car interchanges between railroads, the expanded system will provide information on loadings, unloadings, arrivals, certain waybill data, the crossing of regional boundaries, cars in bad order and cars in storage.

Data communications seminars scheduled

Four data communications seminars will be held in the resort area of Pennsylvania on July 8-19, 1974. Host Farm Resort, located just east of Lancaster, Pa., will be the meeting place for the four seminars covering Data Communications Systems, Terminals in On-Line and Remote Computing Systems, Design of a Data Communication System and Project Management of a Data Communication System. Producer of the seminars is The Institute for Advanced Technology, Control Data Corp. of Rockville, Md.

Railway System Controls Index

Copies of the 1973 annual index of Railway System Controls have recently been mailed to subscribers who in previous years applied for them. Other subscribers desiring the index should address requests to the Circulation Department, Railway System Controls, P.O. Box 530, Bristol, Conn. 06010.



Frisco has completed a new microwave system

The St. Louis-San Francisco Railway Co. has announced completion of its new 1,000-mile microwave system. Costing $3-million to build, the system will consolidate all communication functions for the Frisco in linking the company's main stations on lines between St. Louis, Mo. and Tulsa, Okla., and between Kansas City, Mo. and Birmingham, Ala. into a communications control center in Springfield, Mo.

The newly completed system has basically a 300-voice channel capacity; however, it can be increased to a 600 voice channel as needs dictate. The system is capable of transmitting telephone conversations and teletype messages, in addition to being used by dispatchers in centralized traffic control for most of the railroad.

Equipment for the microwave system consists of 38 towers ranging in height from 70 feet at Valley Park, Mo. to 460 feet at Turrell, Ark., with 25 of the towers being located off the Frisco System property. In addition, at each tower location a small Fiberglas building houses the necessary solid-state electronic equipment and stand-by battery plants. Each station also has a party line telephone circuit enabling maintainers to contact the network supervisor if needed.

The system is said to be relatively fail-proof with each station having duplicate electronic equipment should one set fail, and portable AC generators in event of an extended AC power outage at a site.

A series of elaborate alarms are also part of each station's equipment, identifying trouble by flashing red warning lights to the communications control center in Springfield.

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RAILWAY SYSTEM CONTROLS

ICG moves to 12 channel radio

Twelve channel modular radio communication has come to the rail industry. And it's about time, according to J. C. Taylor, director of communications, Illinois Central Gulf.

Taylor has been calling for two changes to take place in two-way railroad radio communications, for some time now—12 channel capacity and modularity. He's found both in the same unit, and already has installed the radio in 31 locomotives at ICG's sprawling Memphis yards.

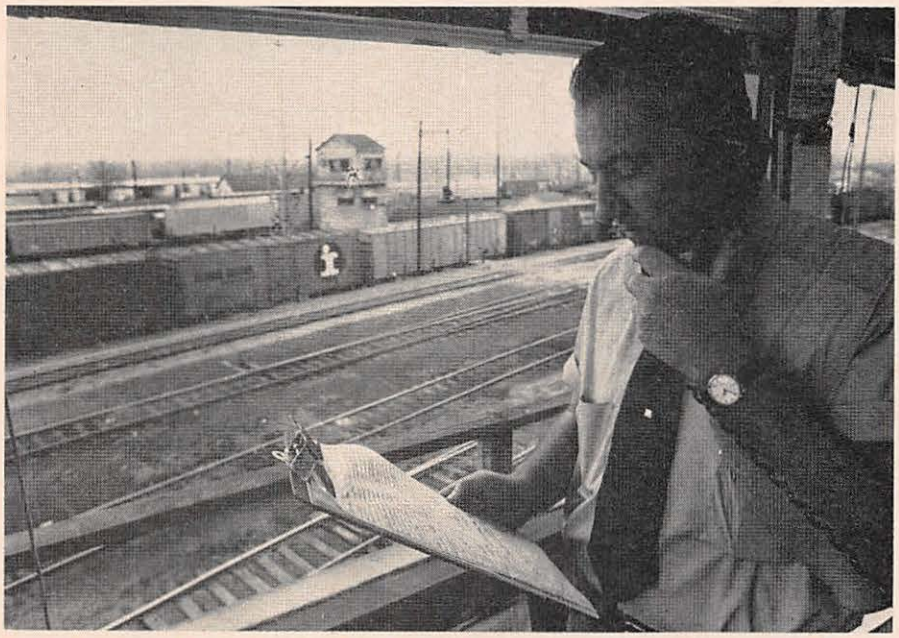
"I've felt for some time that 12 channels were needed to handle our communications load in Memphis," Taylor said. "At the same time, it became apparent that we needed a radio that would help solve some basic maintenance problems. Primarily, I was looking for a locomotive unit that would be easy to service, require less inventory and improve the overall quality of maintenance work performed."

The radio Taylor selected for the ICG is the 4R, a compact modular unit introduced by the Union Switch & Signal Division of Westinghouse Air Brake Company (WABCO) about a year ago. With its modular design, plug-in transmitter and receiver, and compact shape, the WABCO 4R becomes the first 12 channel two-way railroad radio to go into service in the industry.

According to Taylor, run-through trains, larger yards and a steady increase in the volume of traffic handled have all added to the railroad's communication load. Almost 45,000 cars a week are handled in the five Memphis yards of the Illinois Central Gulf. Twenty-seven yardmasters, four of them on duty all the time, make use of a two-way radio communication system to re-classify all ICG traffic going north or south. Installation of the 12 channel units has already helped to improve that traffic flow.

"Most of the radios we had in operation were four channel models," said C. O. Gross, trainmaster of all the Memphis yards. "We had to operate without them quite often, simply because we couldn't match channels between engine radios and hand sets on the ground. Going to the new 12 channel radios means that the engineer only has to flip over to the channel assigned

communications



C. O. Gross, trainmaster at ICG's Memphis yards, directs the reclassification of almost 45,000 cars per week. Before 12 channel two-way radios were installed in the Memphis complex, Gross and 27 yardmasters often found that they had to work without radio communication, simply because there were not enough frequencies available to handle their volume of traffic.

J. C. Taylor (left), director of communications for the ICG, discusses the advantages of 12 channel modular radio design as it applies to ICG's Memphis yards with WABCO representative John Matthews (right). Looking on is Taylor D. Morse (center), ICG supervisor of communications equipment maintenance in Memphis.

the portable radios and he is in instant communication with anyone on the ground."

The WABCO 4R's modular construction was another prime factor in the ICG's decision to switch to the 12 channel radios. According to Taylor, most of the units used in the Memphis yards were 10 or 12 years old and were presenting maintenance problems.

"We had some radios that were as much as 20 years old," Taylor said. "They became entirely too expensive to maintain and replacement parts were almost impossible to get in any reasonable length of time. Because of the inventory of parts we had to keep for those models, I felt that they should be replaced with modular units.

"Now, if a part needs replacing, the module housing the affected part can be removed and quickly and easily replaced with a new module. Plug-in modules also mean that we can update the radios as innovations are made."

Because of the 4R's 12 channel capacity, Taylor expects the incidence of damage to his equipment to decrease considerably. "We discovered that the old radios we were using sometimes were dropped when they were removed from the engines," he said. "Men climbing up and down the side of a locomotive with radios tucked underarm had difficulty in hanging onto the unit, and the radios were damaged when they slipped from their grasp. This added to the amount of time they were out of service."

Not having to remove a radio for a frequency change should lessen damage to the units, according to Taylor. ICG uses 11 yard frequencies and one end-to-end frequency in Memphis.

"Before we went to 12 channels, we had only two choices when a frequency change was required," Taylor said. "We had to line up our locomotives to the jobs on their operating frequency, which was really not practical . . . or, we had to remove the radio and place it in a locomotive needing that radio's frequency."

The WABCO 4R radios in service in Memphis have transmitters that are continuously adjustable from 10 to 40 watts. Transmitters are operational to full specifications with any channel spread within the railroad band.

The 4R's dual conversion-dual crystal filter receiver has a frequency range of 148 to 174 MHz in a single model and an audio output of 10 watts. One to 12 channels are optional on the units.

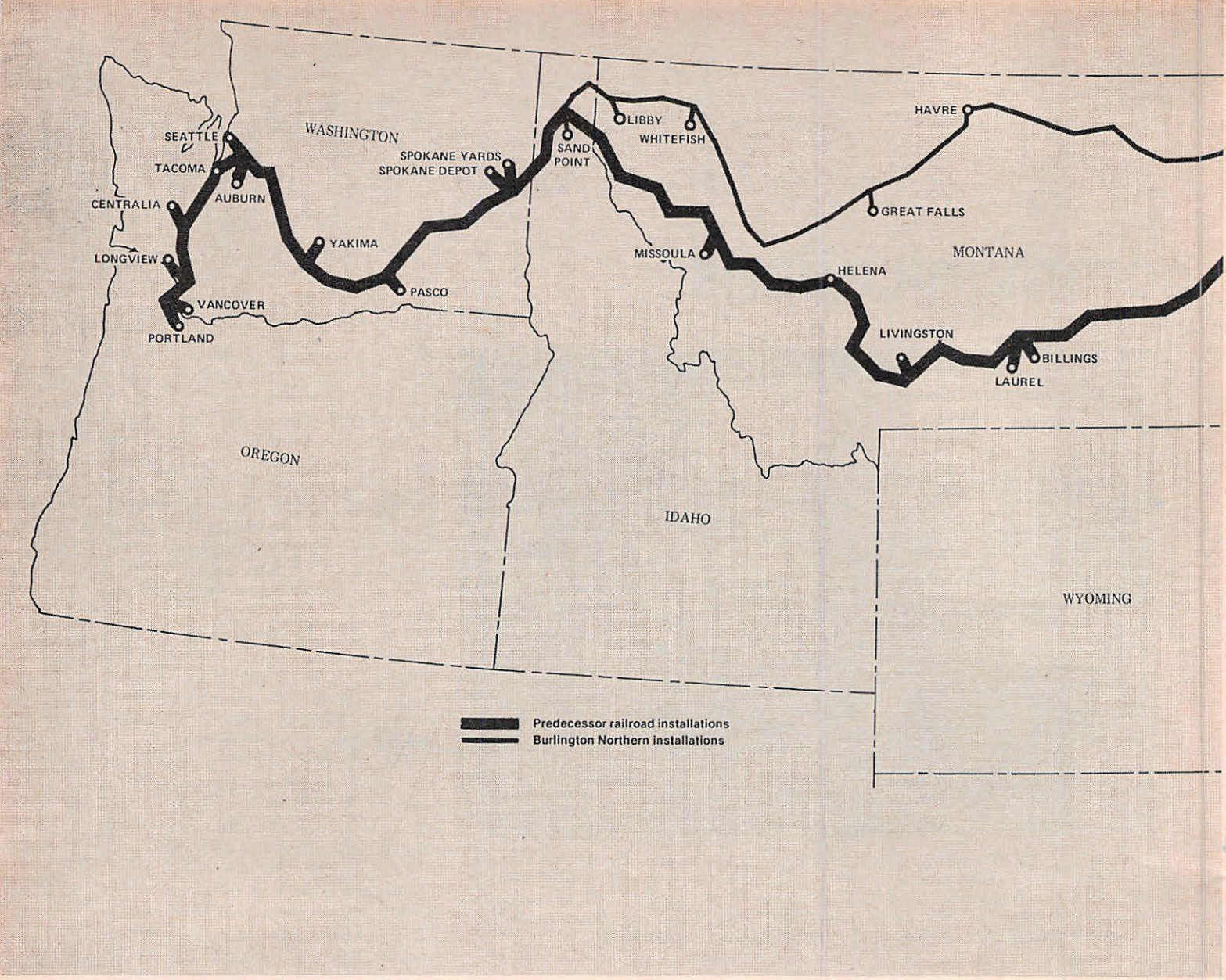
Power supply for the radio consists of only two transistors and provides protection against improper polarity. The 72 volt model is protected for line to ground spike voltages up to 3,000 volts. In addition, internal line to line surge protection is provided that eliminates the need for external filtering devices.

The WABCO 4R Railroad Radio weighs 23 pounds and occupies just over 600 cubic inches of space. The unit, including its mounting base plate, is 3.69 inches high, by 10.63 inches wide, by 16.13 inches long.

All of ICG's 12 channel 4R radios are mounted in locomotives, at the present time. But the compact size of the unit allows for easy installation in cabooses, base stations, base relays and repeaters, automobiles, transit vehicles, and maintenance-of-way vehicles.

According to Taylor, the Memphis installation of 12 channel two-way radio represents the start of a coming communications change in the industry. He expects other lines to follow ICG's precedent.

"On most railroads today, eight channels are needed to adequately handle the communications load," he said. "But that load is increasing . . . and will continue to increase at a steady rate . . . and that means that more channels are becoming an absolute necessity."



BN's microwave expansion nearing

Burlington Northern will be completing a major expansion of its microwave communications network sometime during August of this year. Payoff of this $10 million investment is estimated to be under ten years. When the link between Great Falls, Mont., and Spokane, Wash., goes into operation, BN says the resulting $22.5 million, 4,582 mile network will be the world's largest and longest privately owned microwave system of its kind. It would have the capacity for 600 simultaneous transmissions in either direction, according to T. W. Wigton, director of BN's Communications Division. Of the 600 voice channels 480 channels have been made available by the FCC for railroad use.

In conjunction with the still needed pole line circuits along BN's 25,000 miles of railroad, microwave gives a substantially expanded medium for voice, data and teleprinter transmission. BN uses this versatile system for monitoring the freight cars on its line in conjunction with the computer center at its St. Paul, Minn., headquarters. It is the core of a direct-dial telephone system that extends from Chicago to Seattle.

Present system

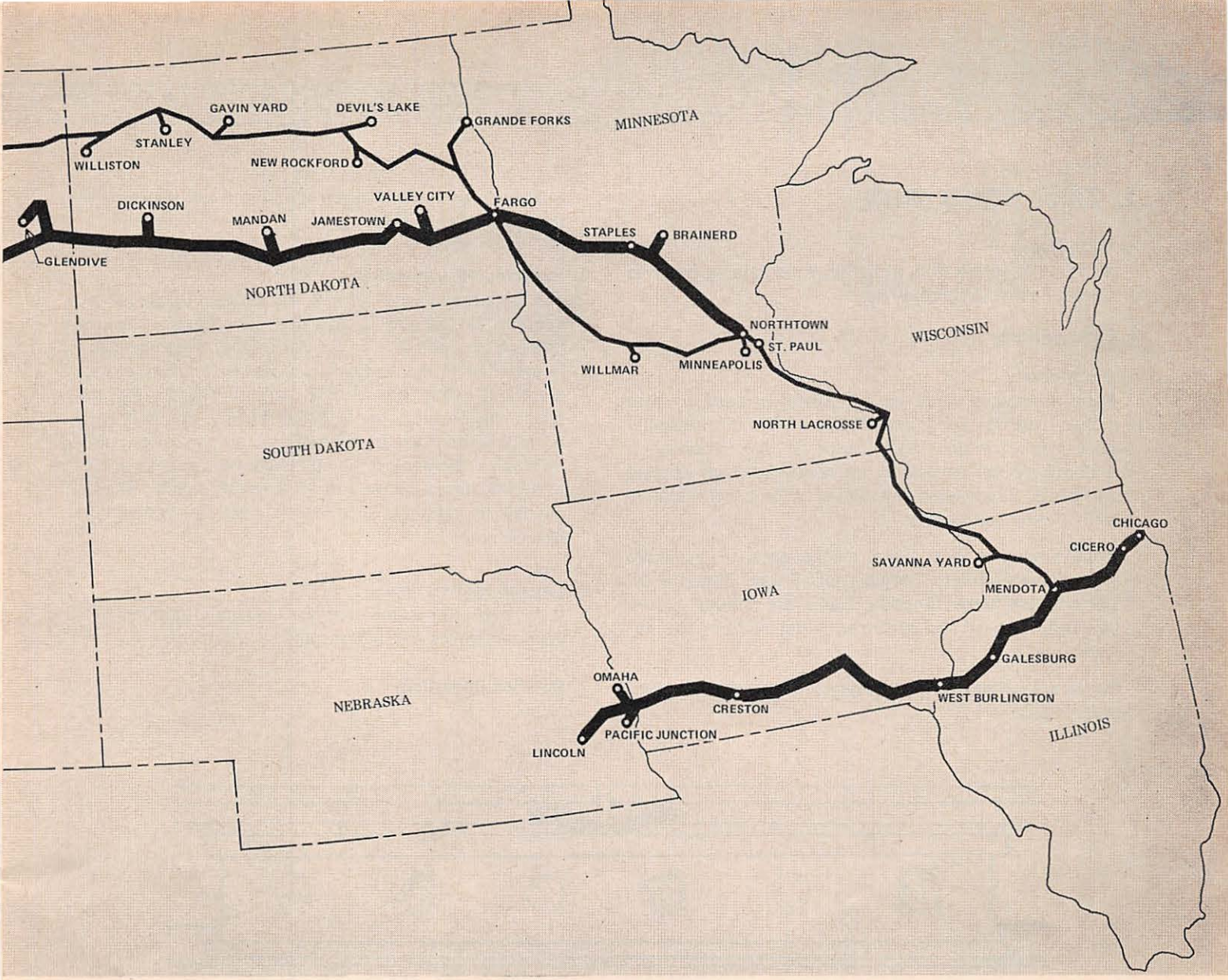
At the time of BN's merger in 1970, two substantial microwave segments were already in operation. Between 1965 and 1967, the former Burlington had established its microwave system between Chicago and Lincoln, Neb. Simultaneously, the Northern Pacific had been making an installation (not completed until 1969) between St. Paul and its western terminals at Seattle and Portland, Ore.

Since the merged system concentrates its through freight traffic on the easier grades of the more northerly of its two mainlines, that through Minot, N.D., the importance of increased communication capabilities along this route were immediately apparent to BN management. It was also desirable that the existing segments be integrated with each other and with the planned extension along the former Great Northern line. Gavin Yard at Minot is the major classification point on this route.

Soon after the merger, in cooperation with Collins Radio which had supplied the equipment for both the CB&Q and NP systems, BN undertook a four-phase program of microwave expansion:

Phase 1—Mendota, Ill., to St. Paul, which was completed in June 1972 and served to tie the two existing segments together.

Phase 2—St. Paul to Fargo, N.D., which went into operation early in 1973 and provided a second "backbone" link along the former GN mainline.



completion

Phase 3—Fargo to Havre, Mont., that opened at the end of March.
Phase 4—Havre to Spokane, Wash., which is now under construction and will be completed in August with the segment to Great Falls, Mont., opening first.

The section now being built across mountainous western Montana presented some problems in securing tower sites. The route along the crest of the Rockies involved clearance for sites deep within the Bob Marshall National Wilderness Area and BN ran into opposition from protesting environmentalists.

209 terminals

The dozen sites finally established in this region presented some substantial construction problems. When they are all complete late this summer, there will be a total of 209 terminal and repeater stations along BN's 4,582-mile system. Tallest of the towers is one 410 feet high just east of Fargo. Others range in height up to 320 feet.

Although BN has two different rail routes between Spokane and Seattle, the original 1969 microwave installation along the former NP route has sufficient capacity so that it was not necessary to provide a second link along the Wenatchee-Everett line.

To extend BN's microwave capabilities beyond its own terminals, they exchange microwave channels with Southern Pacific south of Portland, reaching southern Oregon and San Francisco. There is similar exchange with Union Pacific to complete BN on to Denver from Omaha.

Duplication in the system provides back-up to protect against almost any system failure. There is provision for transmitting all manner of fault indications to supervisory locations on the routes. Stations have battery and standby power system protection. Microwave equipment installations of the Sixties were of Collins MW 308D which does incorporate some vacuum-tube circuitry. New equipment installed on the Mendota-Spokane line is the solid-state MW 318D which assures an added degree of reliability. Much of BN's communication data is transmitted to teleprinters. Data for up to eleven teleprinters can be transmitted within a 4 kc spectrum or one voice channel. Also used for some of BN's data transmission are Collins MX 106 multiplex equipments.

Train radio

While BN is retaining its mainline pole lines for dispatcher circuits, CTC controls and signal power, it has been relocating the VHF antennas for its train radio system on many of the microwave towers to increase the coverage. In this system, communications are relayed from the train, via VHF, to a nearby microwave site to be relayed to another station. All total, BN has well over 8000 two-way radios for train communications.

1. Title: BOND WIRE

2. Definition:
A metallic connection attached to adjoining rails to insure electrical conductivity.

3. Symbol: None

4. Description:
Bond wires are made up of several strands of wire rather than one solid wire. This provides the flexibility necessary to reduce bond breakage due to vibration and rail motion caused by trains moving over bonded rail joints. Below are shown a few of the many methods of installing bond wires.

Bond wires, like most signal components, are available from many suppliers. They do not all look alike, but all perform the same function. Some are welded to the rail head, others are hammered into holes in the rail head, Fig. 1.

Some are hammered into ⅜ in. holes drilled in the rail web, Fig. 2.

Some are hammered into the holes in rail web and in the joint splice bar, Fig. 3.

5. Purpose and Application:
The electrical signal circuit, called the track circuit, depends on current flowing from a source of energy through the rails to a relay. Quite often, when new rail is installed in the track, it is possible to complete an electrical path between the rails by tightening the splice bar or angle bar bolts. Unfortunately, that path is not reliable due to such things as corrosion build-up and dirt between rail ends, angle bars and bolts creating resistance to the flow of current. A bond wire is needed to insure a dependable electrical connection between rails.

6. General Information:
It is most important that you become familiar with your company's instructions and requirements.

7. Detailed Operation:
None.

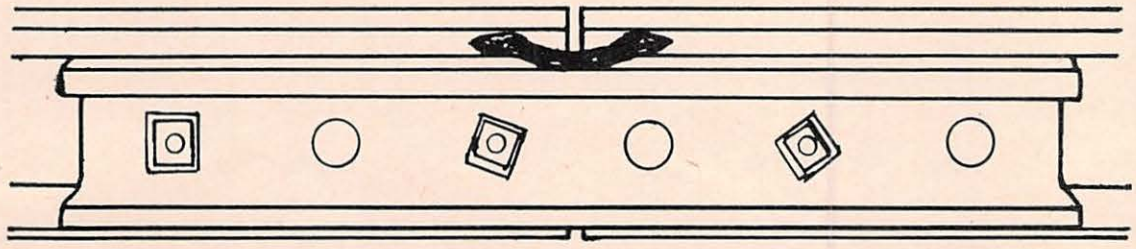


Fig. 1

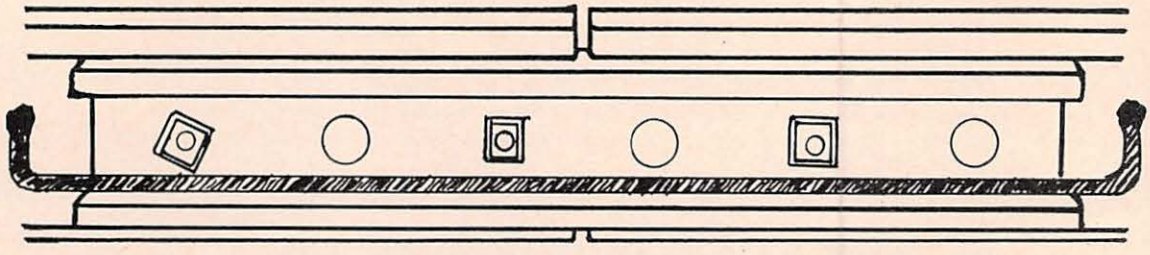


Fig. 2

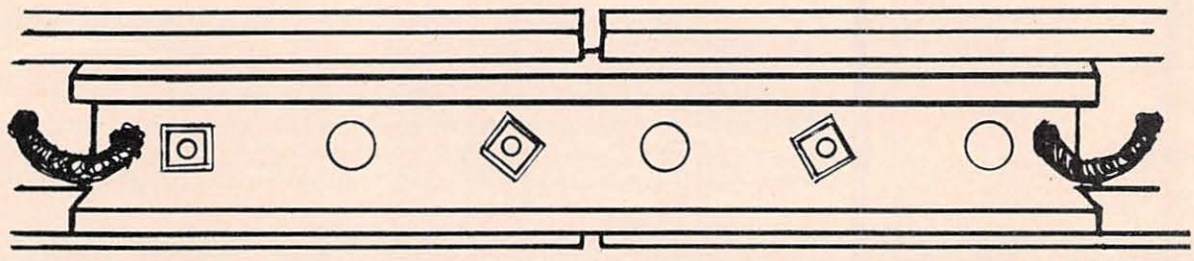


Fig. 3

1. Title: INSULATED RAIL JOINT

2. Definition:
A rail joint in which electrical insulation is provided between adjoining rails.

3. Symbols:

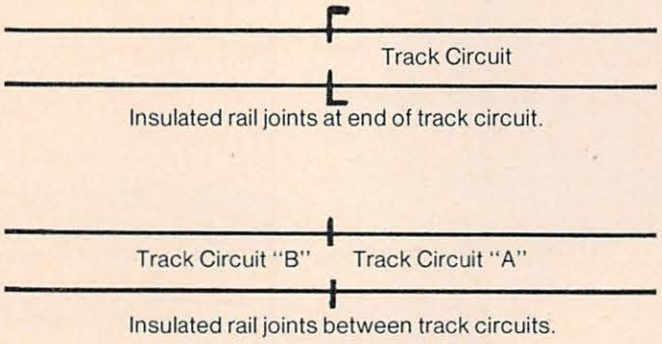

Track Circuit
Insulated rail joints at end of track circuit.
Track Circuit "B"
Track Circuit "A"
Insulated rail joints between track circuits.

Fig. 1.

4. Description:
There are many types of insulated joints on the market. They all employ an end post made of insulating material between the ends of adjoining rails. Since rails are joined together by metal bars and bolts, these must be insulated from the rails to prevent electrical current from flowing from one rail to the next rail. Different types of insulating material are used. Figs. 2a and 2b show two types of insulated joints using fiber insulation. The major difference between the two types illustrated is that the armored joint includes thin metal head pieces to protect the fiber. Fig. 3 is an exploded view of the non-armored type.

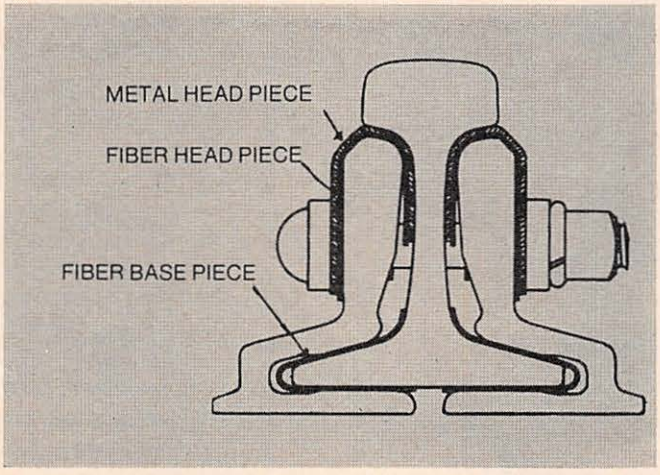


Fig. 2a

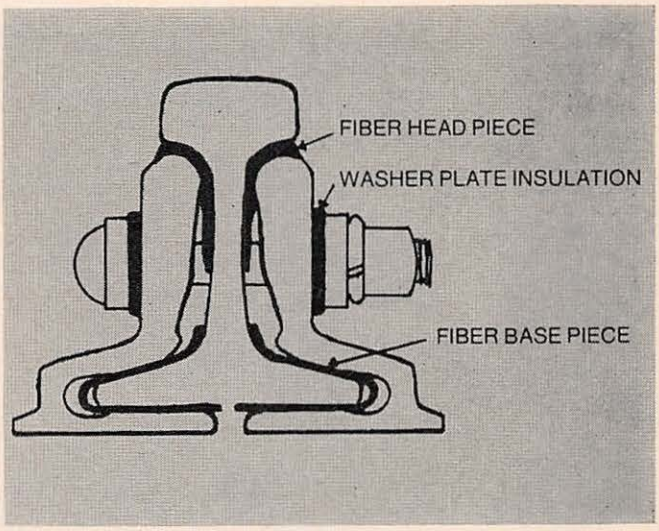


Fig. 2b

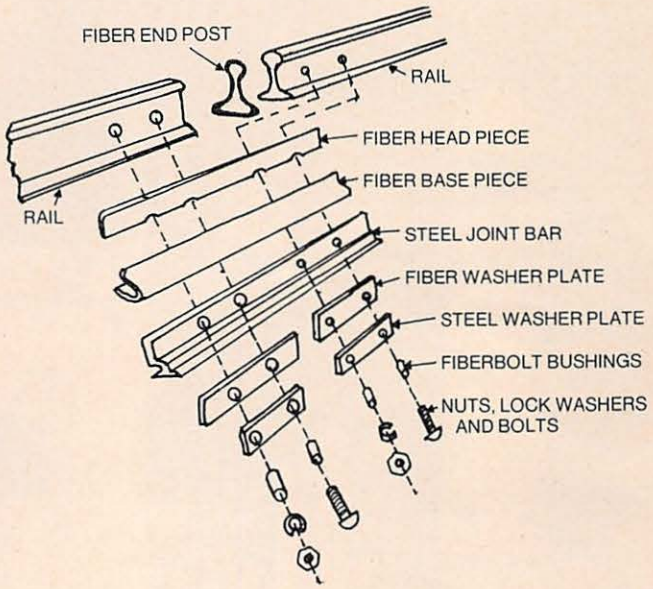
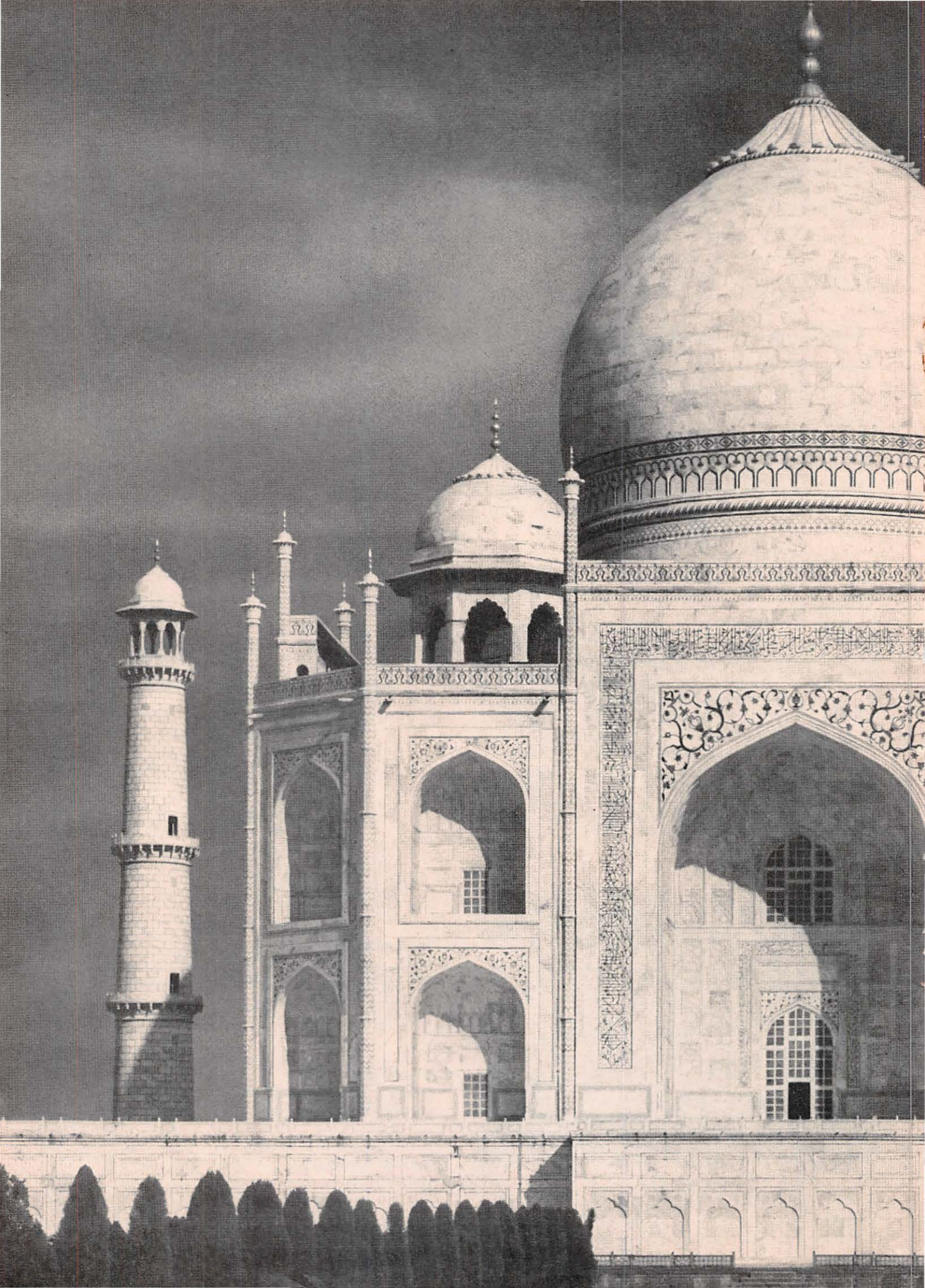


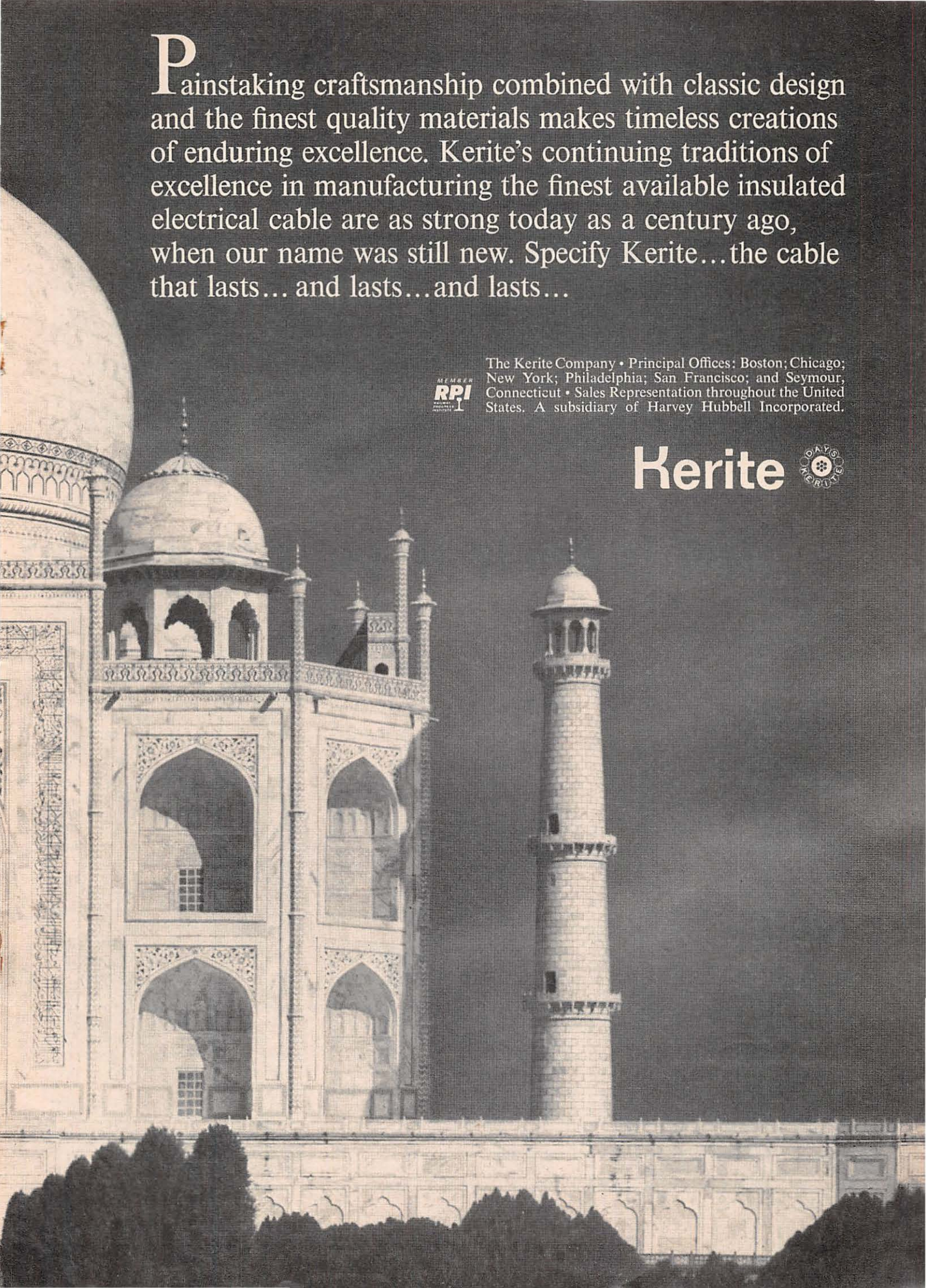
Fig. 3

5. Purpose and Application:
Signal systems make use of track circuits which employ the rails as electrical conductors and insulated rail joints are used to prevent the flow of current where such flow is not required or is objectionable.

6. General Information:
It is most important that you become familiar with your company's instructions and requirements.

7. Detailed Operation:
None




Painstaking craftsmanship combined with classic design and the finest quality materials makes timeless creations of enduring excellence. Kerite's continuing traditions of excellence in manufacturing the finest available insulated electrical cable are as strong today as a century ago, when our name was still new. Specify Kerite...the cable that lasts... and lasts...and lasts...
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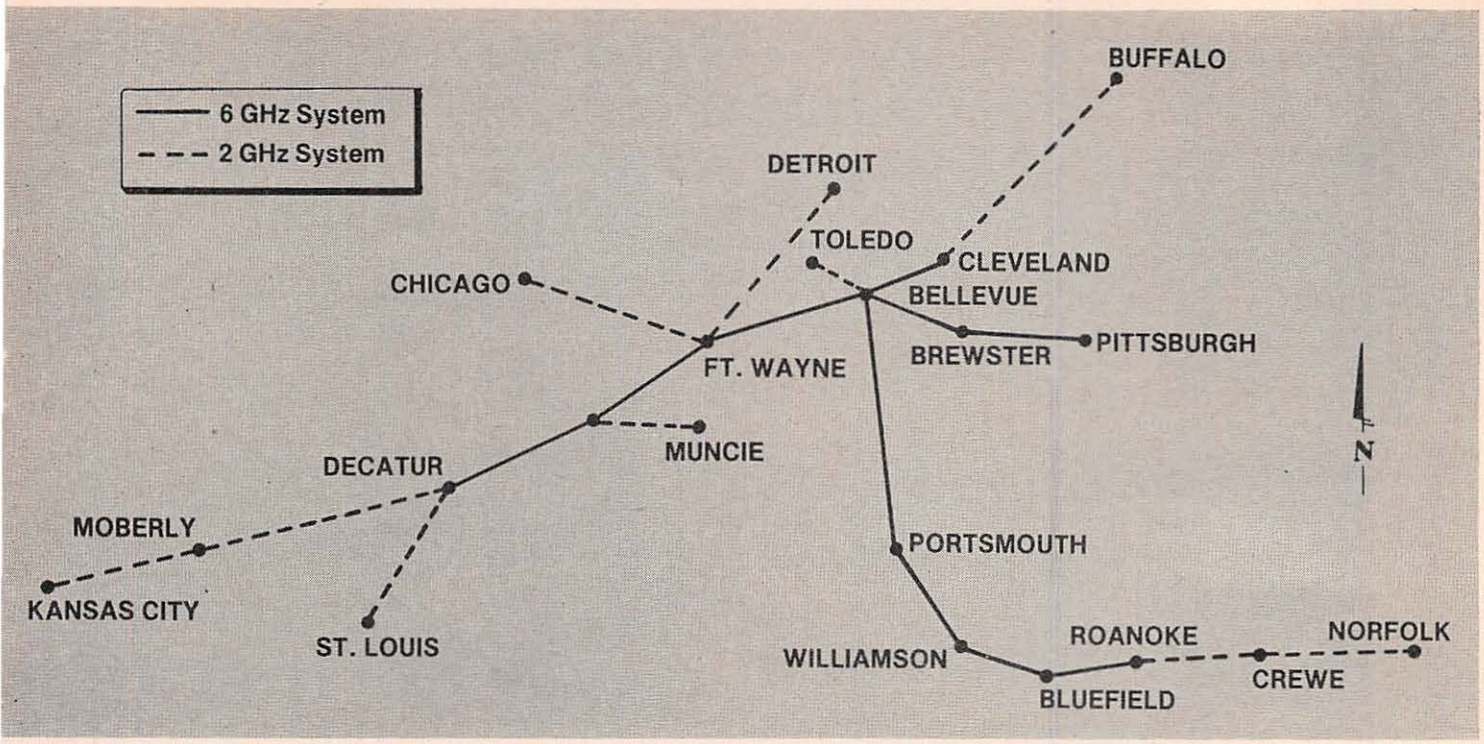


A network of about 100 microwave repeaters could effectively serve NW's communication needs on the core network.

NW is ready to go with system

The final design of Norfolk & Western's long planned microwave and related communication system is now complete. Back in February of '73 NW announced its undertaking of a systemwide program for expansion and modernization of its communication facilities at a cost of about $13 million. Requiring some three years to complete, the project was to include a 2,400 mile microwave radio system designed to accommodate any future requirements. NW's executive vice president, Robert B. Claytor told of replacing much of the company's open telephone lines with microwave radio links along with modernization of telephone switching centers and a VHF train radio system.

During the recent sectional meeting of the AAR Communication & Signal Section in St. Louis, Robert Hettrick, manager of communications for the NW, talked about the steps taken in planning this modern system.

Hettrick started out by explaining why it took so long for systemwide communications to develop on the NW. Since the present NW is a result of a merger of three systems which had their own unique communications systems, establishing communications between each part had to be carried out as quickly as possible. The immediate solution was to lease circuits. Later, additional wire-line-carrier was installed, but this was not enough to replace all of the leased facilities. Much dependence was placed on the use of commercial long distance telephone networks. WATS lines were installed at several locations in order to provide better control of communication costs.

Stopgaps

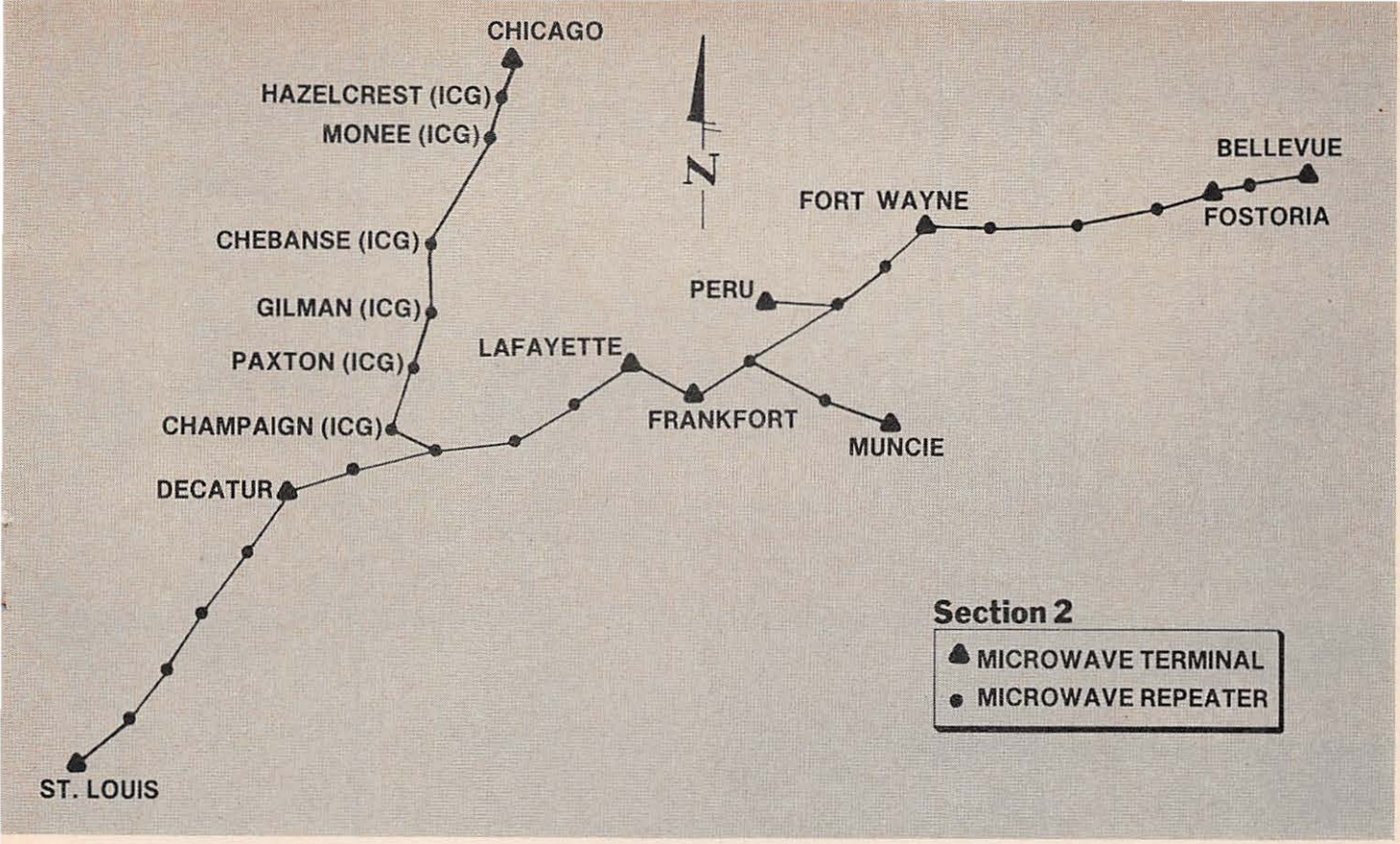
At this point NW's communication personnel realized that the measures taken could only be considered stopgaps. In response to foreseeable needs, a study of ways to provide a more adequate communication system began. Merger negotiations were then in progress with the Chesapeake & Ohio and the Baltimore & Ohio and management could not make a commitment for communication capital expenditures until the results of the negotiations were known.

Upon termination of the merger studies, another look was taken at the communication requirements of the system. While the merger studies had been going on, the wire-line-carrier equipment and railroad-owned telephone switchboards were getting older and less dependable so more circuits were leased to meet the growing requirements for data transmission. Annual expenditures for commercial communications were in the area of $3.2 million.

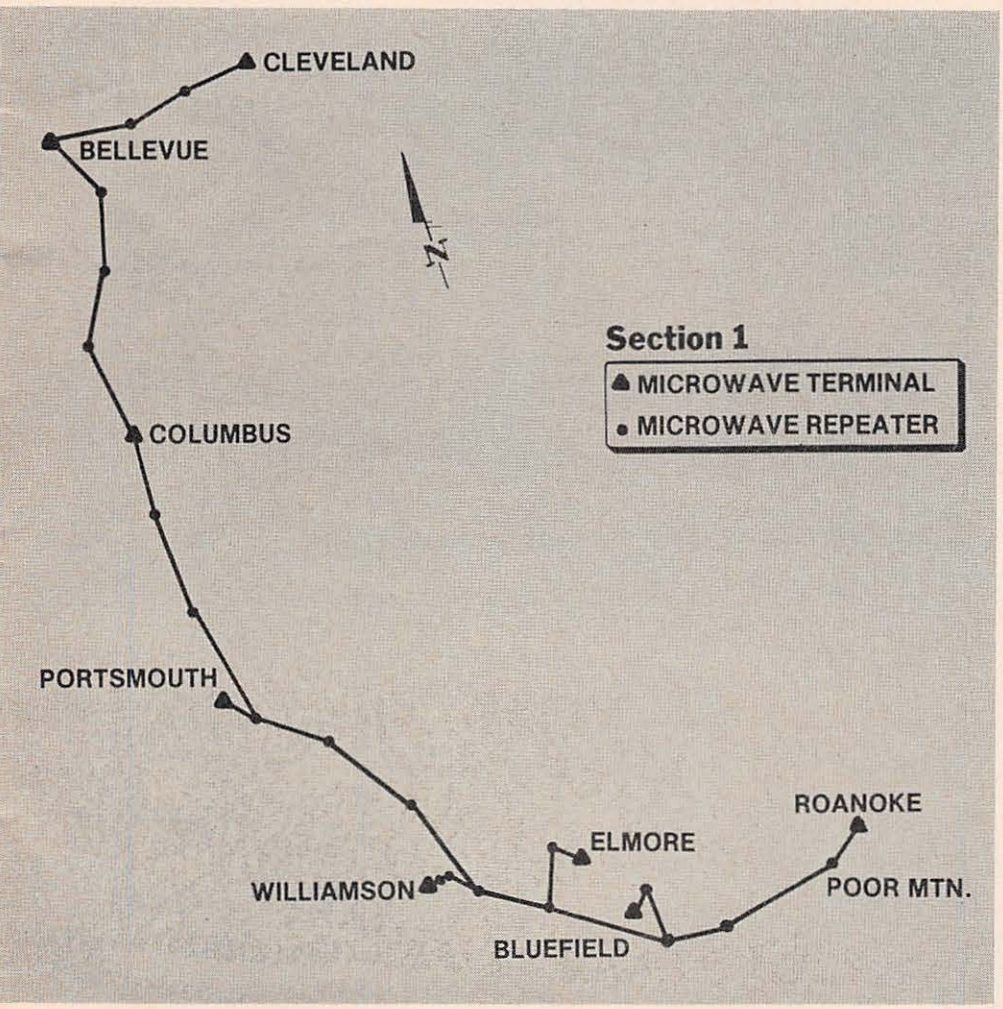
Consultant

Hettrick noted that most railroads have either designed microwave systems using their own personnel, or have contracted with one of the major manufacturers for design of the system. He went on to say that the small size of the communication staff on the NW and the time required to build a larger staff of sufficient size to undertake a design project of this magnitude precluded doing the design with NW personnel. It was felt that contracting with one of the major manufacturers for the design would bias it in the direction of that manufacturer and obtaining truly competitive bids for the system would have been very difficult. On this basis NW decided to have the job done by a consultant. The management consulting firm of McKinsey and Co. was engaged to study the requirements and recommend a course of action. This study resulted in the recommendation for the installation of a backbone microwave system. Page Communication Engineers, Inc., were engaged to validate McKinsey's cost figures, and later to design and prepare the specifications for the system. They began the first phase of their work in September of '72 and the design of the system is now complete.

During the study, it was found that the backbone route west of Roanoke would be heavily loaded; before the design work began, other routes radiating from the hub at Bellevue were found to be more lightly loaded and



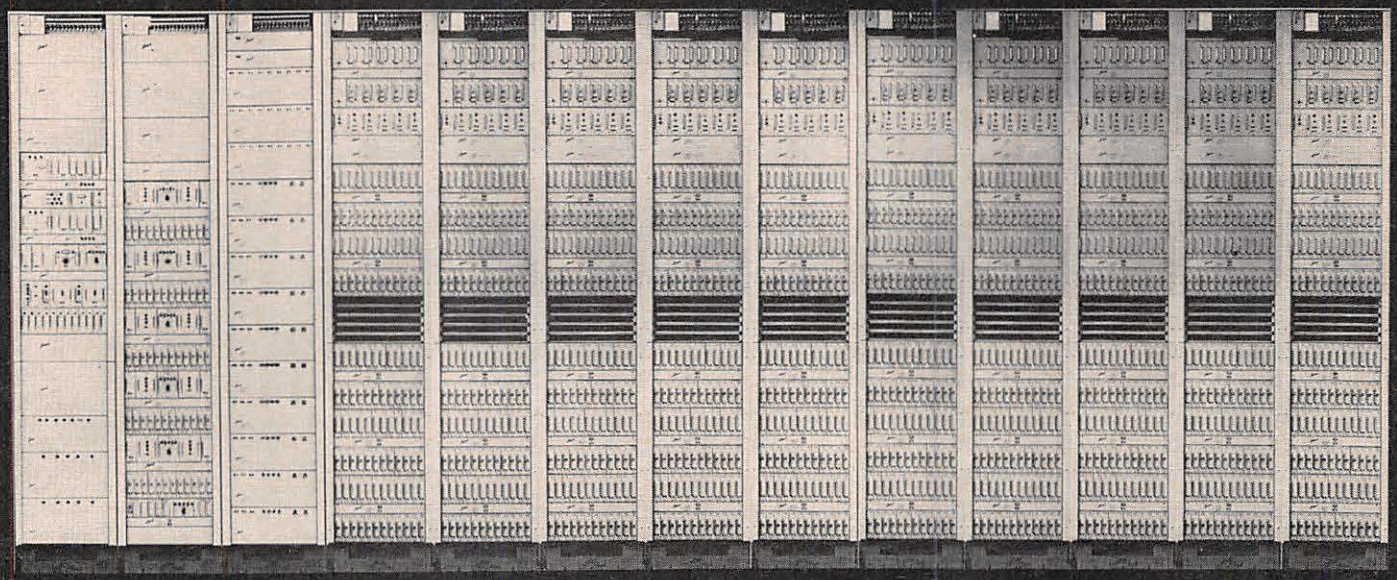
microwave



the far ends, such as routes to Kansas City, were particularly light. In a supplemental report, McKinsey recommended that sharing possibilities be fully explored in order to reduce the unit costs on lightly loaded routes. As a result, NW will be sharing and exchanging much of its facilities with the Chessie and Illinois Central Gulf.

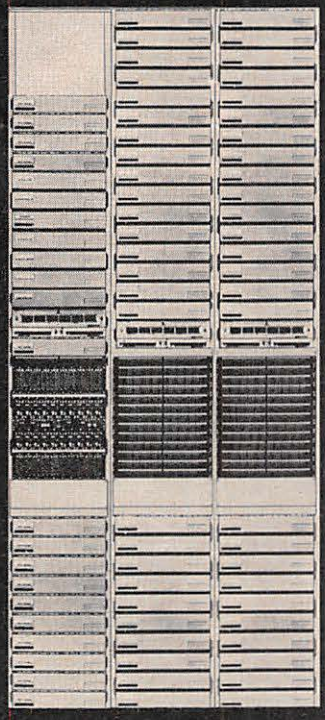
Chessie was interested in building a system from Baltimore to Toledo and Detroit. Chessie also wanted to connect this system to its Huntington, W.Va., office but the loading would have been too much for NW's backbone route. It was agreed that from Laurel Ridge, Ky., near Huntington, to Willard, Ohio, Chessie would have its own radio equipment while sharing NW's sites and antennas. Each company will have its own waveguide to the antennas. At Willard, the systems will be interconnected, with Chessie providing NW base band spectrum to reach spurs at terminals in Pittsburgh, Brewster, Toledo, and Detroit, and the NW providing Chessie with channels to Cleveland, Chicago, St. Louis and some intermediate points. The NW will not build from Ft. Wayne to Chicago but instead will utilize ICG sites from Champaign to Chicago using NW radio equipment. In return, ICG will have use of base band spectrums from Champaign to Kansas City and intermediate points.

The original plan was to construct the system under four contracts. The desire to implement it as rapidly as possible but still avoid the possibility that accepting the most advantageous bid



Before.

Thirteen 9-foot, 19-inch racks—600 channels.



After.

Three 11½-foot, 19-inch racks—600 channels.

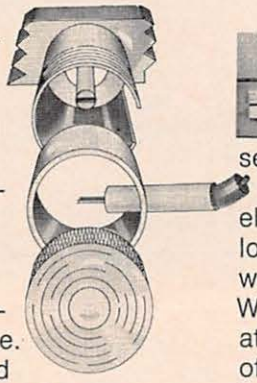
Now our 46A3 multiplex lets you put more of your money into communications, less into concrete.

Since our new 46A3 has shrunk 600 multiplex channels to fit into three 11½-foot racks (or four 9-foot racks—your option) you might naturally assume that floor loading has gone way up. It hasn't.

So now you can use your costly floor space more efficiently and put your money where it counts; in equipment, not concrete.

No new power plants either. Our 46A3's power requirements are way down.

Our little patented polylithic crystal filter deserves triple credit: once for that dramatic overall size reduction, once for cost reduction and once again for the high reliability, quality performance and versatility of our 46A3.

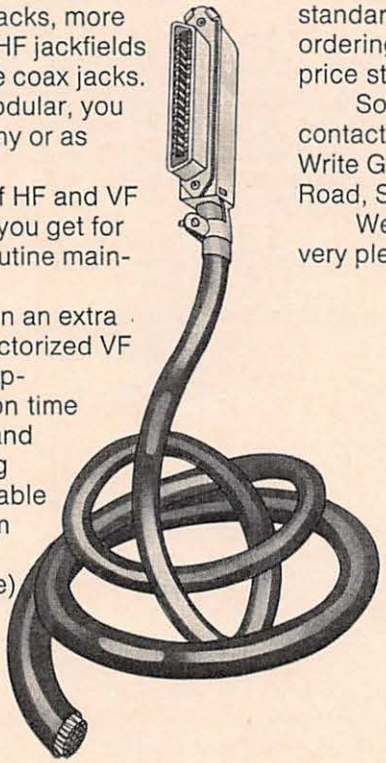


Speaking of patented items, there's a patent pending on our coaxial connector. It simplifies installation so much we use it for both intra- and inter-bay wiring.

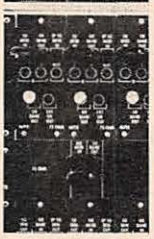
But, coaxial connectors aren't the only simplification of 46A3 wiring. Our

factory-wired racks cut installation costs to the bone. They go a long way toward reducing your maintenance time too.

Since our VF jackfields use miniature tip-ring-sleeve jacks, more space is saved. The HF jackfields also save space by using miniature coax jacks. And since the HF jackfields are modular, you can equip your system with as many or as few as you need.



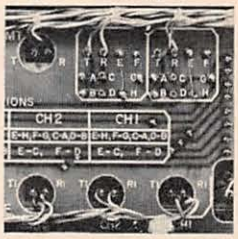
Of course, a big advantage of HF and VF jackfields is the complete access you get for



fast in-service and routine maintenance testing.

We've even taken an extra step: Optional connectorized VF jackfields reduce drop-connection installation time by as much as 50% and minimize cable wiring errors. Tell us what cable length you need (from our connectorized multiplex to your distribution frame) and that's that.

Of all these innovations, the one that you might find most exciting is the 46A3's factory-wired standard assemblies based on a modular, plug-in concept. Combine these standard assemblies with strapping options and you have a highly flexible system designed to accommodate a variety of users and multiplex applications.



Channel strapping options are clearly and completely identified on the back of the shelves for fast, error-free installation.

With a comprehensive alarm system and full-time monitoring; normal operations, routine maintenance, troubleshooting and service restoral are as fast as they are easy.

But, all the 46A3's improvements haven't been electronic. We've used plastic and aluminum for a lower-cost, lighter-weight package. We've even included attractive snap-on plastic covers for the front and back of the shelves. They give you added safety as well as better appearance.

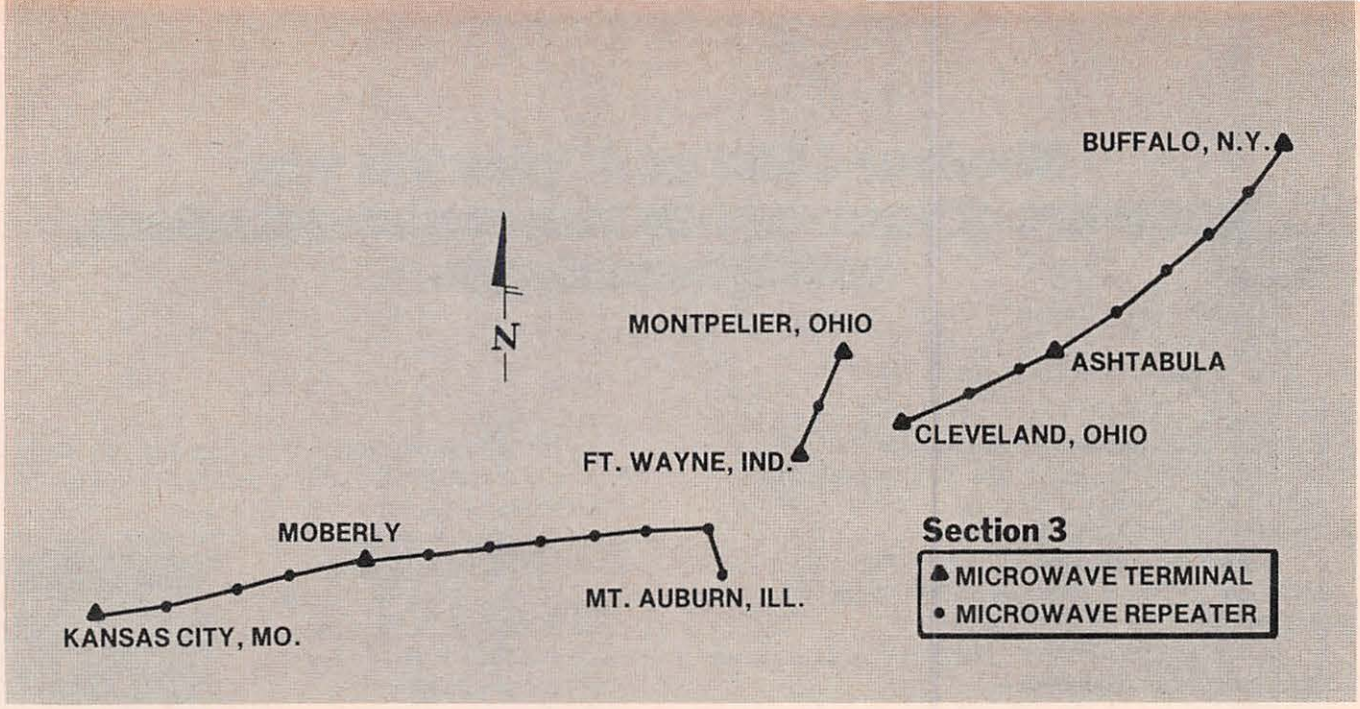
Another non-electronic improvement: Our standard assemblies have simplified engineering and ordering, making it possible to offer you a volume price structure.

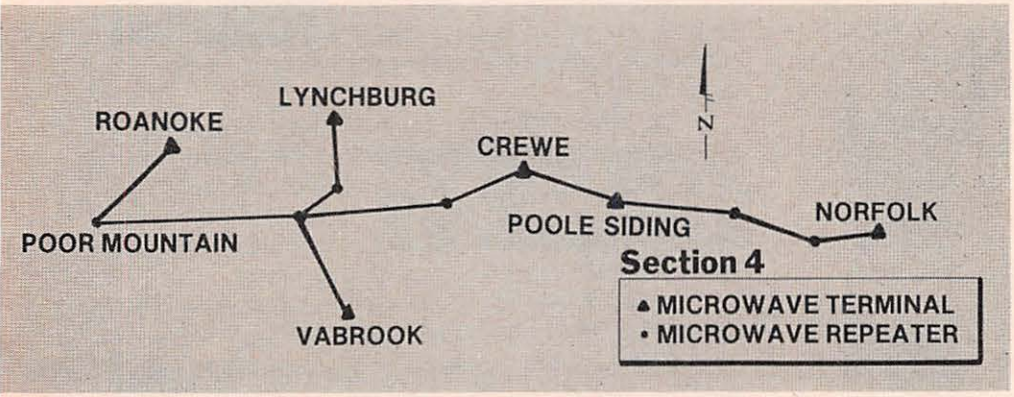
So, before you make any multiplex decision, contact us for more information about our 46A3. Write GTE Lenkurt, Department C134, 1105 County Road, San Carlos, CA 94070.

We have a rackful (or, rather three racks full) of very pleasant surprises for you.

GTE LENKURT

Circle 7 on Reader Service Card.





for each section would lead to diverse equipment, lead to the decision to make one request for quotations. Placing the entire system in service at one time would be impossible so implementation will be in sections. Start of work on one section will not wait on completion of the previous section.

- Section I from Roanoke to Cleveland will be constructed first.
- Section II branching from Section I at Bellevue will be constructed next to St. Louis and Chicago.
- Section IV will be the third portion placed in service from Norfolk to Roanoke.
- Section III will be the final part built and will consist of the spurs to Buffalo, Kansas City and Montpelier as well as the spurs from the Chessie System.

Local drops

The consultant's contract also involved planning for the handling of drops from the microwave to points away from the terminals themselves. Hettrick explained that if potential savings are to be realized from the microwave, as many communication wires as possible must be eliminated from pole lines.

About 70% of NW's trackage is traffic controlled. The traffic control "code line", which has been upgraded to #8 insulated copperweld, will be used to provide local communication. The frequency spectrum on the "code line" will be utilized as follows:

0-300 Hz	Traffic Control
300 Hz–5 KHz	Dispatcher Telephone Circuit
5 KHz–41 KHz	Hot Box Detector and Traffic Control Carriers
43 KHz	Voice and Data Carriers

To minimize losses on the physical voice circuit, carrier terminals will be bridged on the line without filters in series in the line. Since the physical voice circuit on the "code line" has generally been used by the signal maintenance forces, two carrier channels will be assigned to these groups, and the field forces will be provided with portable carrier phones for communication to their headquarters.

The major loading on the microwave system will be the intercity trunks of the dial telephone network. Hettrick says the design of this network is unconventional in that there are no major tandem switching centers. On a microwave system with considerable excess capacity, once NW has committed the cost of the basic radio system, the railroad will incur no extra cost for additional channel miles, only channel terminals. Therefore to minimize additional terminals, direct tie lines will be provided between major points. Traffic between points where there is little demand will be tandem switched on a two-wire basis in standard PABX's. In most cases there will be only one tandem switch in any call and at most, two tandem switches.

The microwave system design itself has several departures from normal practice. First, a minimum fade margin per hop has not been set. Instead NW has set out a specification for 99.99% reliability on the longest circuits from Roanoke to Kansas City. This reduces to a total of 26 minutes per year one-way failures for all the links in this route.

Hettrick concluded: "We expect that in general, the system will have space diversity. At a few locations where we are leasing space on office buildings, we have been able to arrange for only one antenna in each direction of transmission. There is no problem of providing diversity on transmissions from these points by providing two receiving antennas at the far end of the hops. Providing diversity in the opposite direction is more difficult. It is planned to place one transmitter on each of the two antennas transmitting toward the single antenna point, one with horizontal and the other vertical polarization. At the receiving end, one receiver will be on each polarization on one antenna."

CTA works overtime to finish cab signals

The federal government has authorized the Chicago Transit Authority to spend extra money for overtime work to speed up the installation of modern signal equipment for the south elevated route.

Such modern signaling, which controls both the speed and spacing of trains, would have prevented the rear-end collision Friday May 10, on the south route at 29th street in which 217 passengers were reported injured. In the accident, a southbound eight-car train struck another eight-car train which was halted between stations by an equipment malfunction which automatically applied the brakes. An investigation indicated the cause of the accident to be when the motorman of the rear train failed to keep at a safe distance and operate his train within a speed which would have enabled him to stop safely when the train ahead made a stop at an unexpected place.

Milton Pikarsky, CTA Chairman, issued an order for the overtime work on the signal installation project for the south route after conferring by telephone with Jerome C. Premo, Acting Associate Administrator for Capital Grants of the Urban Mass Transportation Administration of the U.S. Department of Transportation.

Premo assured Pikarsky that the federal government would reimburse the CTA for its share of whatever expenditures are incurred for completing the installation of the modern signal equipment as quickly as possible.

Starting the week of May 13, crews of signal personnel and trained technicians began working on an overtime schedule of 12 hours a day and six days a week on the signal project for the south "L" route, also including the Jackson Park and Englewood branches.

The work will include further installation of special equipment along the right-of-way and also the further installation of special equipment in the motorman cabs and other parts of the cars of the trains operated on this route.

For various major parts of the CTA's elevated system, the installation of cab signaling represents an on-going project costing upwards of $25 million.

Modernization program

The cab signaling project is part of a current $140-million CTA modernization program for which the federal government is paying two-thirds of the cost and the Illinois state government is paying one-third.

CTA's cab signal system includes both visual and audible indications when speed restrictions are being imposed upon the advancing train. As a train approaches another train or physical speed restriction, a yellow indication appears on the speedometer at the same time that an audible "beep" is sounded. The yellow indication means to slow to 35 mph. If a motorman does not place his controller in either the 2nd or 3rd rates of braking within 2½ seconds, control of the train is taken from him and the train is stopped automatically. As the train comes closer to approaching another, a red aspect appears coincident with sounding of the "beep" and the motorman must again respond by braking the train.

In addition to overtime work for the south "L" signal project, the CTA also is pushing forward to get installation under way of cab signal equipment on three remaining routes in the program—the Ravenswood route and the Evanston-Wilmette and Skokie Swift branches.

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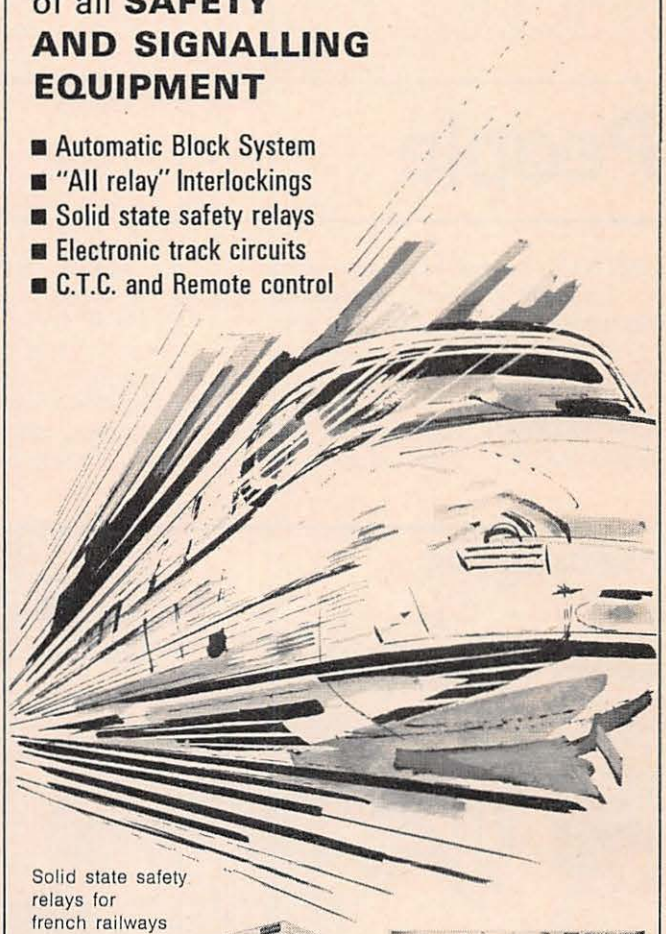
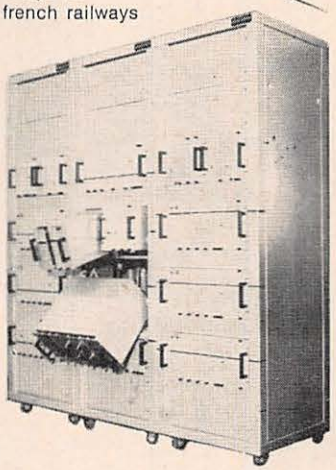


Solid state safety relays for french railways



JS-312

SAFETY - RELIABILITY

Circle 9 on Reader Service Card.

Problems / Solutions

Problem:

With the increasing growth of radio and microwave communications in all types of industry, the problem of high level spurious radiation transmission is affecting electronic equipment of all types, mainly solid state equipment of the computer and data processing variety. Foreign signals introduced by known and unknown sources have been known to inject meaningless data into computer equipment and sometimes erase important information. Sensitive equipment is usually protected by the outer cases and RF gaskets but when these outer covers are removed for maintainence the components are vulnerable to any number of signals which might be present in the area. The ultimate solution, of course, is to control the spurious transmissions at the source. What are some effective methods of controlling the source? What if you can't control the source? How can solid state equipment be protected from these unwanted signals?

People

AMTRAK—**Robert F. Breese,** electronics research engineer, **Association of American Railroads,** Chicago, appointed electrical engineer-development for Amtrak.

ASSOCIATION OF AMERICAN RAILROADS.—Several changes have been made in anticipation of installation of the new car information system, TRAIN II (TeleRail Automated Information Network), which is expected to be fully operational by next year at the AAR's Washington headquarters. **G. L. Constantine,** data information liaison officer, promoted to the newly created position of director for data control and analysis. **R. E. Wandless,** assistant manager, data control and analysis section, promoted to the new post of manager of statistical analysis. **Florence Howdershell,** statistical analyst, named assistant manager of statistical analysis, essentially the post previously held by Mr. Wandless. **T. H. Garcia,** project officer, promoted to manager of data control, a new position.

Retired **Maj. Gen. James A. Bailey** elected vice president, management systems, AAR, Washington. Prior to his retirement from the Air Force in May, Gen. Bailey was comptroller, Air Force Logistics Command, Dayton, Ohio, and was manager of all data processing equipment utilized by the Logistics Command. **Robert B. Curry** will continue with the AAR as a special assistant to the president on management systems problems.

". . . And the little choo-choo said, 'I-think-I-can-I-think-I-can-I . . ."

CHESSIE SYSTEM.—At Hungtington, WV, **William E. Brenner,** district engineer signals, promoted to chief-signals and communications design. **Wayne Cartee,** engineer signal materials and standards, appointed assistant superintendent signals and communications standards. **Hollis G. Helton,** assistant engineer-signals-maintenance, appointed assistant superintendent-signals and communications maintenance. **George W. Kearney,** manager communications-engineering and operations, named assistant superintendent-signals and communications construction. **Wilbur R. Mohler,** signal supervisor at Cumberland, promoted to supervisor-signals and communications, Huntington. **Billy L. Morris,** engineer signal development and design, promoted to assistant superintendent-signals and communications engineering. **Robert R. Pace,** engineer communications-inside plant, promoted to chief-signals and communications estimates. **Cecil A. Stokes,** signal and communications engineer, **Western Maryland,** Hagerstown, appointed assistant superintendent-signals and communications maintenance, Huntington. **Arnold C. Trimble,** superintendent signals, advanced to assistant chief engineer-signals and communications. **J. Herbert Wallis,** superintendent communications, appointed superintendent signals and communications engineering.

SUPPLIERS

The **Federal Sign & Signal Corp.,** Chicago, has appointed the general managers of its three operating divisions as presidents of their respective divisions. They are **Ray F. Greving,** Signal Division; **Richard L. Tannehill,** Western-Cullen Division; and **William W. Anthony, Jr.,** sign division.

Paul L. Wheeler, divisional vice president and general manager, Minneapolis Division, **Safetran Systems Corp.,** has been elected a corporate vice president.

Thomas R. Punch has been named director of marketing, **Harris Controls,** Melbourne, Fla. **Lou E. Goetz** succeeds Mr. Punch as director of programs and development. Mr. Goetz was formerly general manager, Richardson Co.

Cecil H. Mayse has joined **National Railroad Construction Corp.,** Atlanta, Ga., as director of engineering and construction. Mr. Mayse has been involved with automatic control systems utilizing millivolt circuits subject to sub-zero temperature readings.

The **Okonite Co.** has appointed the following district sales representatives: **Norman C. Averill, Jr.,** New York: **Peter H. Rast,** San Francisco; **Frederick D. Green,** Washington, D.C.; **Frank D. Rimkus,** Detroit; **Joseph P. Wenski,** San Francisco.

District managers named: **Ronald W. Dearwater,** Denver: **Robert A. Buente,** Salt Lake City; and **John F. Coyle,** San Francisco.

On June 1, Okonite's St. Louis sales office moved to Le Chateau Village—Suite 309, 10411 Clayton Road, Frontenac, Mo. 63131. **Leonard T. Nystrom** is district manager and **Joseph R. Artime,** sales representative there.

Okonite's Atlanta district sales office has moved to 1260 Winchester Parkway, Suite 125, Smyrna, Ga. 20080. **Eugene O. Chapman** is district manager and **J. Malcolm Hartley,** sales representative, there.

Okonite's Philadelphia sales office has moved to 100 South Kings Highway, Cherry Hill, N.J. 08034. **William J. Patterson** is district manager; **Mark J. Brill** and **George R. Reeves** are sales representatives there.

George K. Oss has been promoted to director of teleproducts, **Atlantic Research Corp.,** Alexandria, Va.

Alan F. Culbertson has been elected vice president, **Culbertson Radio Division, Cushman Electronics, Inc.,** Sunnyvale, Calif. Cushman acquired the digital microwave radio product line in February from Culbertson Industries, Inc., of which Mr. Culbertson was the founder.

D. A. McConnell has been appointed account representative, **Uniswitch Division of WABCO** at Vancouver, B.C. Previously, he was signal construction supervisor, **Canadian Pacific.**

Harris-Intertype Corp. on May 15 officially changed its name to **Harris Corp.** The change was made because the company has expanded beyond its original base in printing equipment into electronic communications, integrated circuits and data handling systems.

Ray F. Greving
FS&S

Richard L. Tannehill
FS&S

Wm. W. Anthony, Jr.
FS&S

Paul L. Wheeler
Safetran

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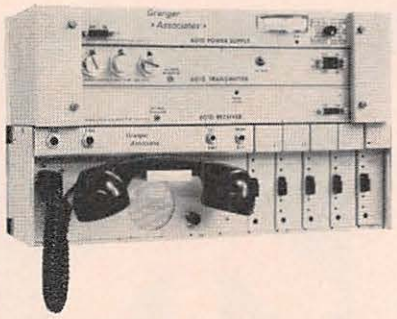

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LETTERS

D&RGW traffic control

Denver, Colo.

To the Editor:

Your very fine story on the Rio Grande traffic control system [RSC, March, p. 10] did us proud.

We were delighted with your handling.

G. B. Aydelotte
Chm. & Pres., D&RGW

Grain Valley, Mo.

To the Editor:

When the March issue of RSC magazine arrived in Grain Valley it caused a remarkable amount of hoopla. Of course we are not being totally objective because of our special interest in your excellent article on the D&RGW system and my accompanying comments on the Future of CTC; however, even apart from these articles of direct personal interest, we are all in agreement that this issue of the magazine is a big improvement in editorial content over anything in recent memory. You are to be congratulated for your outstanding efforts in developing some good meaty material of technical interest to people in the field. We sincerely hope this indicates the beginning of a trend in this direction.

Robert E. Heggestad, VP &
Gen. Mgr., Harmon Electronics

Signal Training Bulletins

St. Louis, Mo.

To the Editor:

Reference is made to the AAR signal training bulletins published in the March issue of RSC and to your introductory explanation of the bulletins.

The publishing of these bulletins, which are prepared by Committee G of the C&S Section, is a real service to the carriers and I want to express my personal appreciation to you and to Simmons-Boardman.

J. L. Weatherby
S&C Engr., MoPac

Tradeoffs in AFO

Rochester, N.Y.

To the Editor:

I was very pleased with your inclusion of my paper "Tradeoffs in the Design of Audio Frequency Track Circuits" in the April 1974 issue of Railway System Controls. I think you did a splendid job in the layout of the article and the redrawing of my figures that accompanied the paper.

Klaus Frielinghaus
Sr. Research Engr., GRS

OPERATIONS & SIGNALING BASICS ARE AGAIN AVAILABLE

RAILROAD OPERATION AND RAILWAY SIGNALING: The basic text which explains the relationship between train operation and railway signaling is now available in reprint form. The text is in the form of questions and answers so that the reader may know the objective of the information given, and to place emphasis upon the "why" and "how" of railway signaling and railroad operation.

Topics covered include fixed signals, block signaling, interlockings, centralized traffic control, cab signals and highway grade crossing protection. This is a reprint of the 1953 edition of RAILROAD OPERATION AND RAILWAY SIGNALING by Edmund J. Phillips, Jr., Simmons-Boardman Publishing Corp., 350 Broadway, New York, N.Y. 10013. Softbound. Price: 1 to 9 copies at $5.95 each; 10 or more copies at $5.00 each. To obtain copies, please fill out the coupon and send check or money order along with your order.

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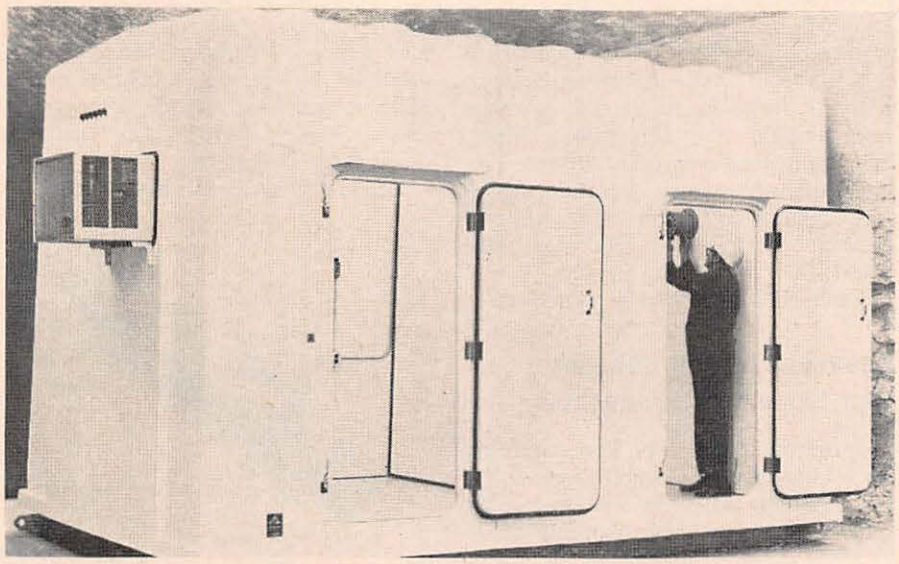
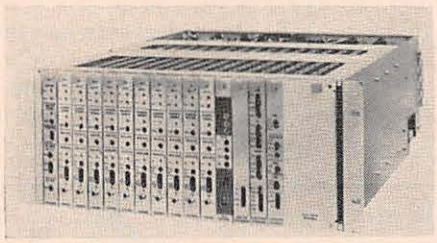


Plastic structure protects electronic equipment

A controlled environment building designed to protect sensitive and sophisticated equipment against moisture and dust in remote locations has been successfully used for housing equipment involved in microwave communications, railroad car identification, telephone switching and other associated applications.

The building is of "dome-type" construction. The dome consists of two one-piece molded shells of fiberglass-reinforced plastic structurally bonded to a rigid urethane core. The floor is of sandwich panel construction with resilient floor covering. Dome and floor are sealed with urethane elastomer poured between the floor edge and dome skirt. Door frame is molded into exterior shell and door is of similar construction to dome.

The building is said to be resistant to fire and requires little maintenance. Any damage to dome can be repaired on site. Doors and other openings can be located anywhere in the dome or floor. The building can be partitioned and pre-equipped with electrical wiring and mechanical equipment to customer specifications. The building is available in five standard sizes ranging from 6 ft by 8 ft by 9 ft-3 in. to 10 ft by 16 ft by 10 ft-7 in. as single unit structures and in 12 ft. wide by unlimited length modular construction. *Grasis Fabricating Co. Circle 101 on Reader Service Card*



Speech-plus terminal combines voice and data

General DataComm GDC 1300 Series Speech-Plus Terminals permit efficient interference-free use of both voice and data channels on a single voice grade line. The data channels use GDC CHAN-L-STAK Frequency Division Multiplexing techniques which allow channel bandwidths to be tailored to required terminal data rates. Available in three families which permit differing ratios of speech and data bandwidths, the terminal can provide voice communications, ringdown, signaling and data channels.

In typical trunking applications, voice communication is provided between two switchboards or PBXs. Simultaneous voice, ringdown, signaling and data communication is provided by the terminal. Ringdown and signaling can also be provided via inband signals from the switchboard or PBX.

In typical subscriber applications, voice communication is provided between a switchboard or PBX and a subscriber or between two subscribers.

In these applications, the terminal allows reduction in the number of lines required and a corresponding reduction in telephone line cost.

The terminal package is based on a seven inch high mounting shelf that accommodates two Speech-Plus-Data Filter Modules, a Telephone Adapter Module, up to 10 FDM Channel Modules, a Common FDM Interface card,

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and an optional Test Message Generator card. Additional FDM Channel Modules, when required, are contained in a second shelf. The SF Signaling unit and Echo Suppressor are mounted in a second seven inch high shelf for installations where they are required. *General DataComm Industries Inc.*

Circle 102 on Reader Service Card

Pocket-size FM radio has flexibility

A pocket-size "PE" Series FM two way radio for use either as a hand-held radio or to be plugged in a car is one of several types of portable units in General Electric's line of communication equipment. The bottom of the PE Series case is a rapid-change power pack providing flexibility in battery supply. Lexan and steel are used for mar resistance and ruggedness and integrated circuitry has been incorporated in the design. The plug-in version of the equipment, using a charger receptacle in the vehicle, is optional. Output power of PE models vary according to the frequency licensed. The equipment may be used with satellite receivers in outlying locations to extend coverage over a wide area. For more complex communication networks, options include eight-frequency operation, search lock monitor and many other features. *General Electric Communication Systems.*

Circle 103 on Reader Service Card

Span line switch satisfies Bell System requirements

A new electronic span line switch has been introduced by Lynch Communication Systems which is said to be fast enough to satify TSPS requirements of the Bell System. Called the B302, the Electronic Span Line Switch is capable of switching a faulty span line to a spare in 50 micro seconds. The B302 is capable of protecting 12 span lines with 1 spare in just seven inches of vertical rack space. Other salient features include lower power drain because of CMOS logic and the equipment has no relays or power supply card and is guaranteed for 2 years. *Lynch Communication Systems, Inc.*

Circle 104 on Reader Service Card

AutoReg charger redesigned to include new features

C&D's AutoReg charger has been mechanically redesigned and repackaged to include numerous new features. The new charger starts delivering current at 25 amperes/100 ampere-hours of rated capacity, which is said to be greater by as much as 25% over conventional chargers. Thus, maximum energy is returned during the early part of the recharge cycle when the battery accepts energy with maximum efficiency. The charger is fully automatic and output voltage is said to be unaffected by AC line voltage variations of as much as 10% above and below normal line voltage. Maximum accessibility is provided by the new package design and an interlock switch de-energizes power circuits when the front panel is opened. *C&D Batteries.*

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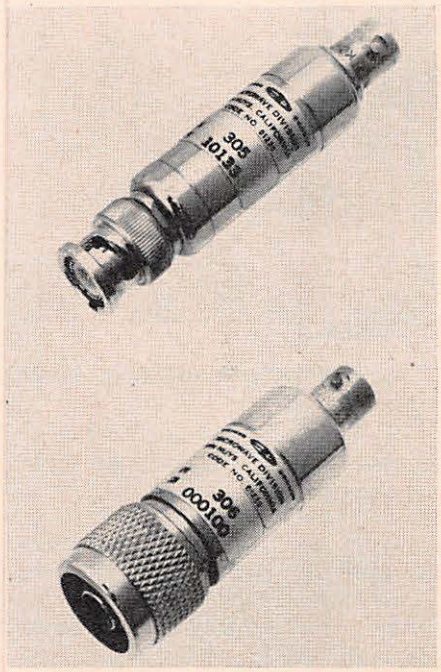

Coaxial crystal detectors are for UHF and microwave

Two new coaxial crystal detectors for UHF and microwave frequency applications have been announced by Systron-Donner Corporation.

Model 305 is a detector covering the 100 kHz to 2,000 MHz range. It is said to exhibit a flat frequency response of ±0.3 dB over the entire range with ±0.1 dB over any 100 MHz increment. In demodulator applications, input

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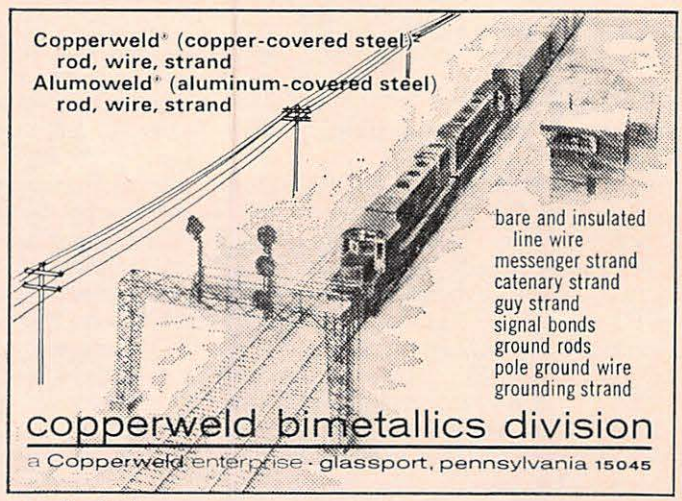

Circle 12 on Reader Service Card.

power levels for the square law region are up to approximately −15 dBm. Operation is essentially linear above +7 dBm.

Model 306 is a microwave crystal detector operating from 10 MHz to 12.4 GHz. Its response is said to be flat to better than ±0.2 dB per octave and ±0.5 dB over the entire range. Operating into an open circuit, the square law range of the Model 306 extends to approximately −17 dBm. *Systron-Donner Corp.*

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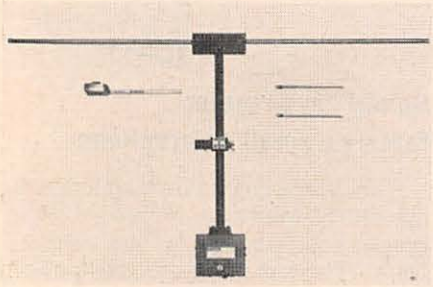

Antenna suits CATV compliance tests

The Dipole Antenna Kit is said to perform accurate spurious radiation measurements as required by FCC Part 76 Sub-part K, when used in conjunction with a suitable receiver or detection device. Model KT-5-105A operates from 20 to 300MHz when used with meters having an input impedance of either 50 or 75 ohms.

The Dipole Antenna operates as a half-wave dipole with linear polarization throughout the frequency range 27 to 300 MHz and also may be used throughout the 20 to 27 MHz range as a fixed length dipole tuned to 27 MHz. Two sets of telescoping antenna elements are used to cover the frequency range. The telescoping elements are adjusted to the appropriate length for half-wave dipole operation at a given frequency by use of a calibrated tape measure that is provided. One set of elements is adjustable from 27 to 140 MHz and the other, smaller set, is adjustable from 140 to 300 MHz. *Singer Instrumentation.*

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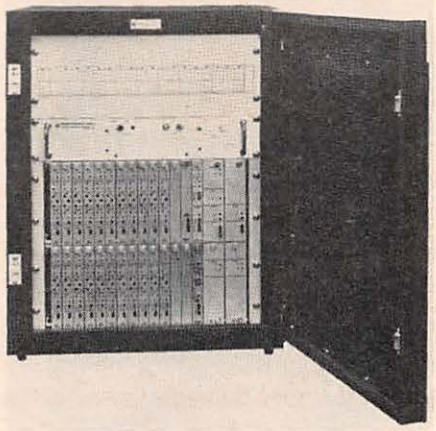

Synchronous multiplexer can accommodate 62 channels

The TDM 1251 is a bit interleaved time division multiplexer designed specifically for synchronous data communications networks. The TDM 1251 is said to provide the capability to configure data networks of various speeds to gain flexibility from currently available and planned common carrier services including the ultra-high-speed digital networks.

Totally transparent to data, the TDM 1251 can be incorporated into a network with no changes in system operating concepts. The TDM will operate with any standard input rate from 600 bps and will multiplex to a maximum output speed of 256 Kbps. Up to 62 input channels can be accommodated.

The TDM will accept serial, synchronous inputs. It can be configured to appear as a data set, or as a data terminal from the standpoint of the interface. The standard configuration accepts rates of 1200, 1800, 2400, 3600, 4800, 7200, 9600, and 19,200 bps. Other rates are available on special order. *General DataComm Inc.*

Circle 108 on Reader Service Card

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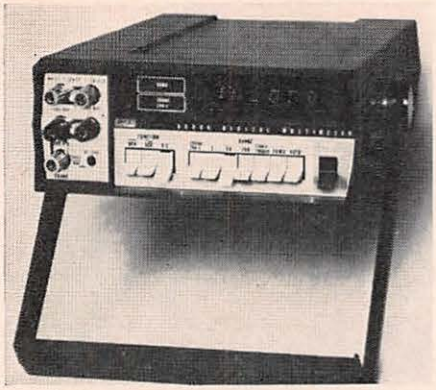

Digital multimeter has a 200,000 count capacity

An 0.005% automatic digital multimeter with a 200,000 count capacity has been announced by a manufacturer of precision electronic instruments and automatic test equipment.

Using proprietary large scale integration technology for reliability, the new Fluke 8800A offers the user five ranges of DC volts from ±200 mV to ±1200 volts, four ranges of AC volts from 2 V to 1200 V, and six ranges of 4-wire ohms resistance from 200 ohms to 20 megaohms. Input resistance is greater than 1,000 megohms on the 200 mV, 2V and 20V ranges and 20 megohms on the 200 V and 1200 V ranges. Common mode rejection is said to be better than 120 dB DC to 60 Hz. Normal mode rejection is said to be better than 60 dB from 50 to 60 Hz. Input is fully guarded and isolated from ground loops, noise loops and stray voltages. *John Fluke Mfg. Co.*

Circle 109 on Reader Service Card

CRT display terminal is compact

Designed especially for distributed data processing systems, the D-302 Informer is a compact, light-weight computer terminal which may be used to enter information on a screen and transmit the data to a central computer. In typical applications, a mini-computer used for high speed communications to large-scale central processors needs only one port to collect data from up to 128 of the D-302 polled block mode terminals.

Each terminal provides standard keyboard spacing and configuration, a separate 10-key number pad and special function keys. Characters on the screen are said to be extremely bright, clear and sharp. The CRT may be rotated to minimize reflections and suit the operator's convenience. A lock and key prevent unauthorized use of the terminal. *Car-Mel Electronics, Inc.*

Circle 110 on Reader Service Card

Electrical tester is able to perform several tests

The model LT-2B is a portable electrical safety tester used to determine leakage current of 115/230 VAC power operated instruments, appliances and devices. The LT-2B measures leakage current under various conditions including equipment with power on, power off, and with the AC line in normal and reverse polarity it will determine if the load is correctly wired for the lowest possible leakage current.

Also, the LT-2B gives a positive indication as to the position of the "on-off" switch in the power line, i.e., whether it is in the "hot" side, neutral side, or if both legs are being switched. Ground wire resistance can also be measured with the instrument from as little as 0.1 ohm up to 2 ohms.

Leakage readings are obtained in three separate ranges: 0-20, 0-200, and 0-2000 microamperes. Resistance readings are obtained from 0-2 ohms. Frequency response is said to range from 10 to 1,000 Hz at −3 dB. *Bio-Design, Inc.*

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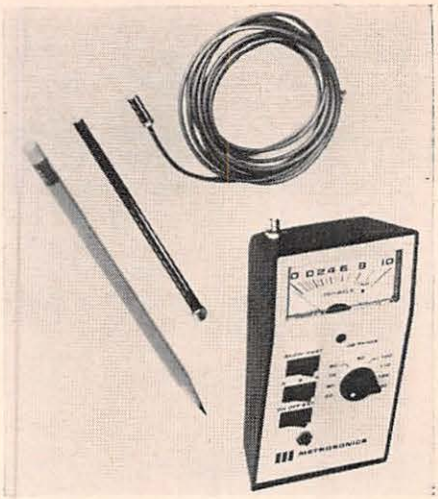

Sound level meter features small microphone

The Metrosonics db-202 allows the operator versatility in locating a microphone for all types of noise measurements. The instrument is available with either miniature, pendant, or boom microphones. The pendant mike measures ¼ inch in diameter by ⅝ inches long, and is attached to a subminiature 5 foot shielded cable.

The boom mike is ¼ inch in diameter by 4½ inches long and for general purpose sound level applications the boom mike is attached directly to the db-202. Standard extension cables in lengths up to 100 feet are available for remote measurements. *Metrosonics, Inc.*

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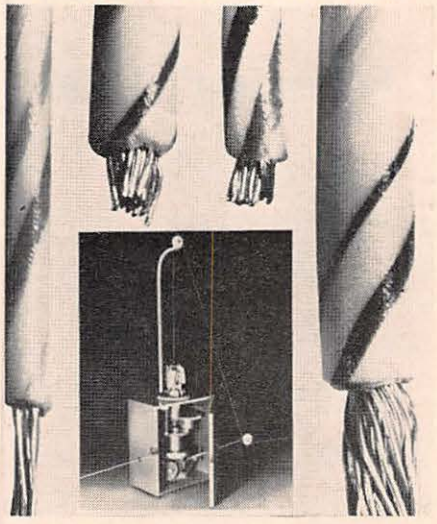

Striper is used for coding circuit wires

A new device, WYR-STRYPER, is available for color coding circuit wires by single, double or triple striping the wire to be identified. It handles wire diameters from .020 to .250 inches and spirally stripes at rates of 10 to 200 feet per minute. Up to three colors can be applied simultaneously. *ETC of ITT Corp.*

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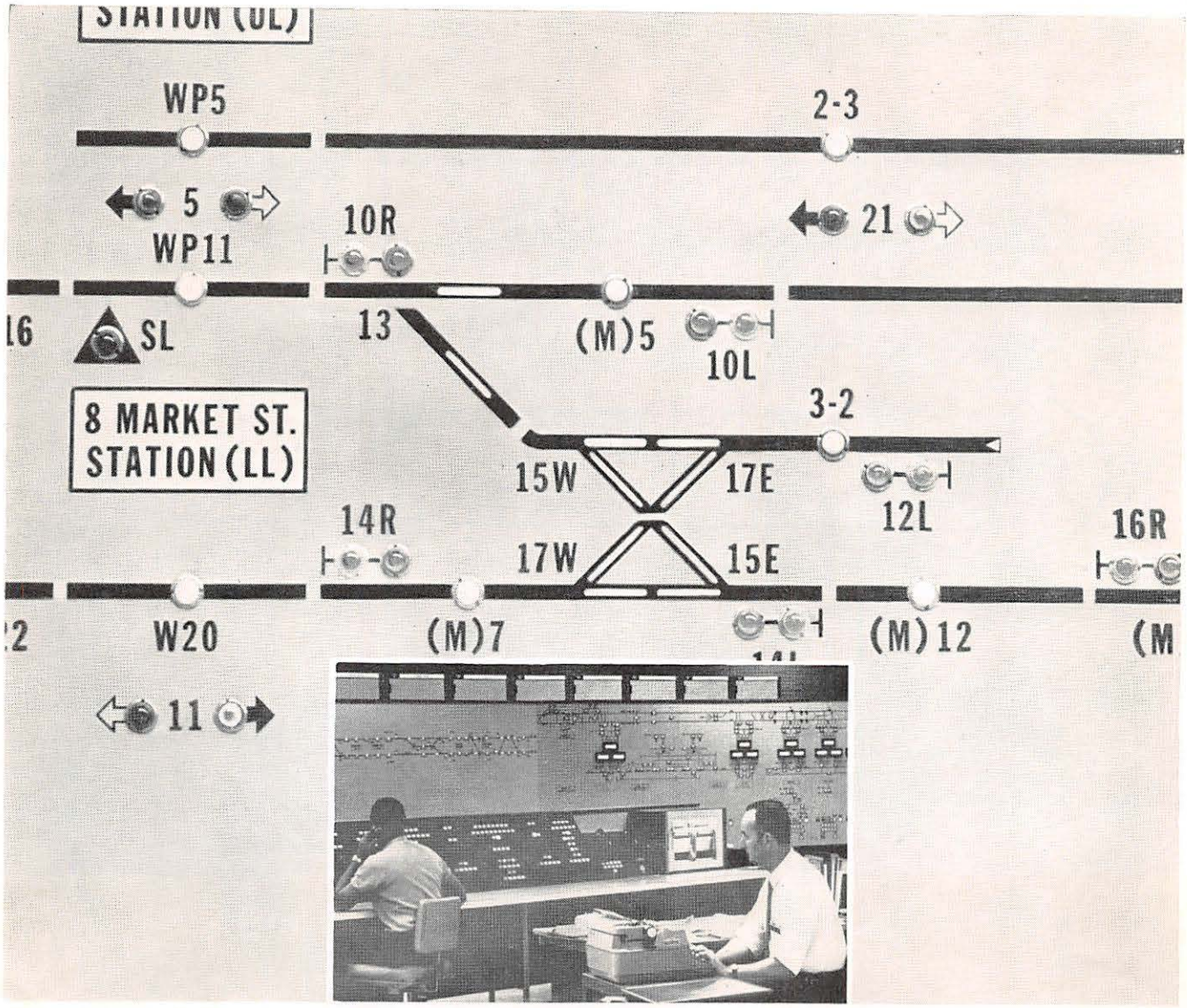

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PATCO's Lindenwold line races between Philadelphia and Lindenwold, N.J. carrying 38,000 passengers daily. It has an outstanding record for on-time service.

Key to the service is the WABCO Supervisory System at Camden Central Control. The track diagram panel continuously displays the location of all traffic on the line along with status of switches and signals. The WABCO control console provides control or monitoring for the following functions.

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- switch point snow melter control
- subsystem-in-use indication for digital data system sharing
- lamp test control for console and track diagram
- alarm acknowledge-pushbutton and indication
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Supervisory control of substations is provided on a separate panel.

Combine this control with voice communications throughout the system over a TRAINPHONE® System and you have some idea of why the Lindenwold line runs so well. We'd like to tell you more about it.

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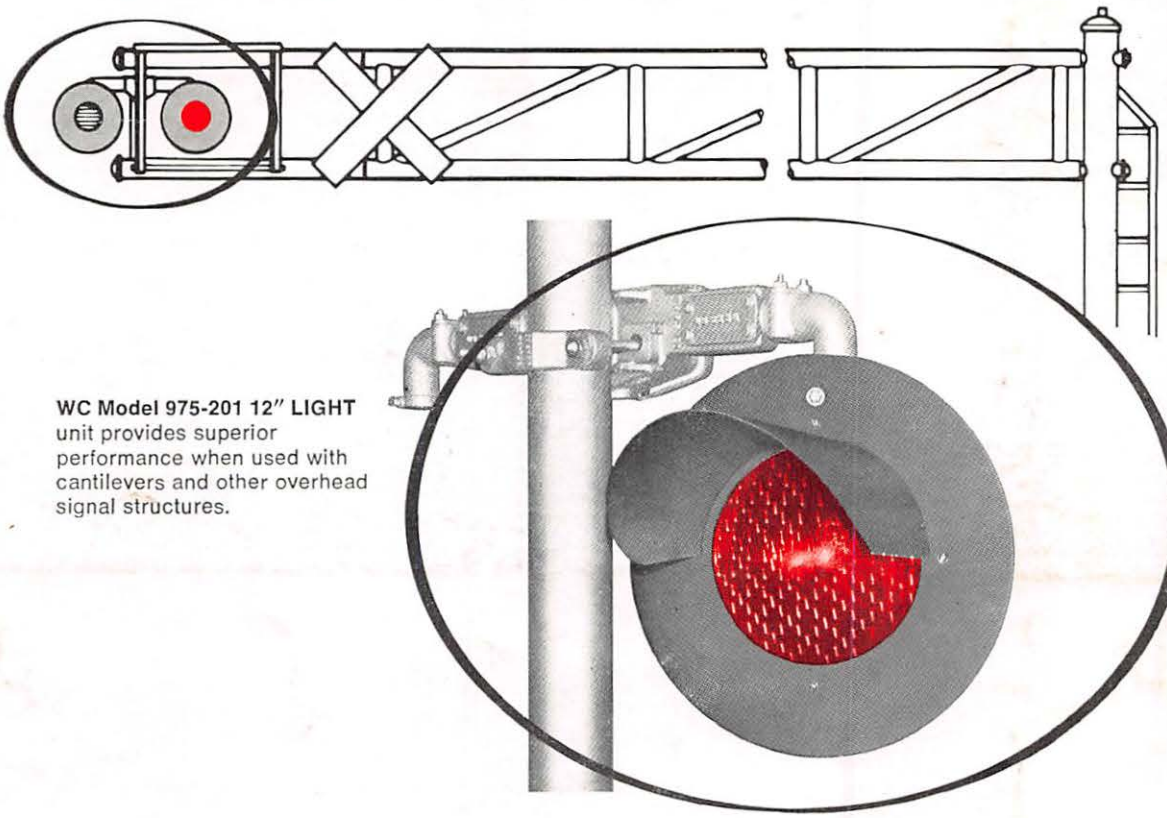
Western-Cullen model 975-201

BIG 12" LIGHT

Increases warning visibility, allows motorists more stopping time



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- **Provides maximum efficiency in light distribution and control**
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Large, silvered glass parabolic reflector captures more of available light and reflects it through the roundel. High-impact polycarbonate plastic used in lens surpasses glass, butyrate and acrylic plastic in impact resistance. The WC 12" light unit uses the same wattage bulbs as the smaller 8⅜" light units. The light unit is easily adjusted. Easily installed, the Model 975-201 12" light unit will fit existing 8⅜" installations. Durable housing is made of maintenance-free aluminum.

ORDERING REFERENCE	Description	Part No.
	12" Light unit, complete:	975-201
	If ordered separately 20° x 32° Hot Spot Roundel:	5368

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